ABSTRACTS OF NORTH AMERICAN GEOLOGY

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INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports of memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

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Indus. Minerals—Industrial Minerals. Metal Bulletin Ltd. London, England.

Iowa State Jour. Sci.—Iowa State Journal of Science. A quarterly of research. The Iowa State University Press. Ames, Iowa.

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ABSTRACTS

03383 **Aalto, Kenneth R.** Specialization and professionalization of pre-Civil War North American geology: Jour. Geol. Education, v. 17, no. 3, p. 91-94, tables, 1969.

Between 1812 and 1862 American geology underwent rapid development to become a specialized, highly professional science practiced by individual researchers whose achievements received world-wide acclaim. This development may be ascribed to freedom from the conflict of uncompromising traditions so prevalent in the early development of European geology, the dependency of American geologists on field observation, and the high level of scientific communication with Europe. The thinking of American geologists was dominated by an interest in exploration, classification, and theory with little utilitarian purpose.—Author's abstract

03423 **Adams, R. D.** Early reflections of P'P' as an indication of upper mantle structure —A reply [to discussion by E. R. Engdahl and E. A. Flinn, 1969]: Seismol. Soc. America Bull., v. 59, no. 3, p. 1419, 1969.

The SKKKP phase cannot explain the arrivals preceding P'P' from the shallow earthquakes reported by Adams (ibid., v. 58, p. 1933-1947, 1968), but it appears that Engdahl and Flinn (ibid., v. 59, no. 3, p. 1415-1417, 1969) may have correctly reinterpreted some of Adam's reported precursors from deep earthquakes as arrivals of this type. The danger of some misinterpretation is inherent in work such as Adams has undertaken; the main purpose of his paper was to revive interest in the possibilities of this method as a means of mantle exploration.—DBV

03082 **Aki, Keiiti.** Study of earthquake sources from the seismic spectrum [with French abs.], *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 190-193, 1969.

Earthquake sources have been primarily studied at two extreme frequencies, zero-frequency (static deformation) and infinite-frequency (first motions). Recent developments in long-period seismology have made it possible to use the spectral density of surface waves at long period for estimating the source parameters. We have now several examples in which all these three methods give consistent results with the assumption that an earthquake is a moving dislocation. In principle, it should be possible to use the entire spectrum range for obtaining the source parameters. In practice, however, it is difficult to eliminate the effect of propagation media from the spectrum at short periods to isolate the source function. One way of avoiding this difficulty is to measure the spectrum near the source. Problems involved in such a study are discussed, taking the Parkfield earthquake as an example.—Author's abstract

03126 **Akpati, Benjamin N.** New technique for serial sectioning of foraminifera: Jour. Paleontology, v. 43, no. 4, p. 1046-1048, 1969.

The use of biological microtomes in sectioning foraminiferal tests makes it possible to cut continuous serial sections from the same specimen for light microscopy and also offers a potential for use in cutting electron microscopy size sections. Epon 812 (mixture B) gives the most satisfactory results, producing smooth sections free of bubbles. The microtome technique is a more rapid, flexible, reliable, and even cheaper method of sectioning than the conventional grinding or the peel method. —Author's abstract

03368 **Alexander, Charles S.** Landforms of the Colorado delta, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. E34-E37, illus. [1969].

Shore forms are identified on overlays to three Gemini photos, and the classification in terms of which they were identified is given. Features shown include volcanoes, alluvial fans, sand dunes, and salt marshes.—ESL

Alpha, T. R. *See* McKelvey, V. E. 03513

03118 **Amsden, Thomas W.** A widespread zone of pentamerid brachiopods in subsurface Silurian strata of Oklahoma and the Texas Panhandle: Jour. Paleontology, v. 43, no. 4, p. 961-975, illus., table, 1969.

A zone of brachiopods represented by *Kirkidium pingue pingue* Amsden and *K. pingue latum* n. subsp. comprises the uppermost Silurian strata and in most places is directly overlain by Lower or Upper Devonian strata. The *Kirkidium* bearing beds are useful in recognizing the Silurian-Devonian boundary, being of particular value in those areas where this contact falls within a carbonate sequence. The *Kirkidium* zone is Upper Silurian (Ludlovian) in age, and is believed to represent an offshore lateral facies of the Henryhouse Formation of south-central Oklahoma.—*from* Author's abstract

Anderson, Don L. *See* McGinley, John R., Jr. 03405

03507 **Anderson, Jay Earl, Jr.; Bickford, M. E.; Odom, A. L.; Berry, A. W.** Some age relations and structural features of the Precambrian volcanic terrane, St. Francois Mountains, southeastern Missouri: Geol. Soc. America Bull., v. 80, no. 9, p. 1815-1818, illus., table, 1969.

Rb-Sr ages have been calculated from an isochron plot of whole-rock samples collected from individual volcanic and intrusive bodies. They form two major groups that average 1415 and 1320 m.y., respectively. A volcanic subsidence structure, the Taum Saulk Caldera, displaces rocks of the older group but is intruded by a granite of the younger group.—AH

03009 **Anderson, W. I.** Lower Mississippian conodonts from northern Iowa: Jour. Paleontology, v. 43, no. 4, p. 916-928, illus., table, 1969.

Fourteen species of six genera of conodonts from Lower Mississippian (Kinderhookian) rocks are described and illustrated. Conodonts were collected from the Prospect Hill Siltstone and the Maynes Creek and Eagle-City-Iowa Falls Members of the Hampton Formation at several localities in north-central Iowa. The faunas suggest correlations with the Hannibal and Chouteau Formations.—JWH

Andrews, H. N. *See* Skog, Judith E. 03550

Andrews, Henry N. *See* Gensel, Patricia. 03519

02965 **Andrews, J. T.** The pattern and interpretation of restrained, post-glacial and residual rebound in the area of Hudson Bay, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 49-62, illus., 1969.

The recovery of the Earth's crust from glacial loading is divided into three periods: (1) restrained rebound prior to deglaciation of a site, (2) postglacial rebound, and (3) residual or amount of rebound still remaining. The relation of Hudson Bay to former glacial centers is discussed by an appraisal of a map illustrating isolines on the marine limit and on postglacial uplift. A true isobase map showing relative land movement in the last 6,000 years is presented. Calculations on the amount of residual rebound are made and a map is drawn. A cross-profile running NW-SE illustrates possible values and trends of restrained rebound. The center of Hudson Bay appears as an area of convergence rather than an uplift center. Uplift centers are indicated over the area of Baker Lake and over east Hudson Bay.—*from* Author's abstract.

03320 **Angino, E. E.; Galle, O. K.; Waugh, T. C.** Fe, Mn, Ni, Co, Sr, Li, Zn, and SiO_2 in streams of the lower Kansas River basin: Water Resources Research, v. 5, no. 3, p. 698-705, illus., tables, 1969.

An attempt is made to ascertain the background levels and to measure seasonal variations of selected trace and minor elements in the major streams of the lower Kansas River basin. Knowledge of the trace element chemistry of river waters is becoming increasingly more important as the rate of use of stream waters increases. Excepting the case of strontium, no strong relation between trace element concentration and lithology was noted. To ascertain properly trace element background levels in streams, long-term sampling covering at least one seasonal cycle is essential. Variations in drainage basin geology have only a minor controlling influence on the trace element geochemistry of the wastes studied.—Authors' abstract

03521 **Angino, Ernest E.** Far infrared absorption spectra of plagioclase feldspars, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 9-11, illus., tables, 1969.

Several well-resolved major and minor bands are present in the far infrared spectra (500-30 cm^{-1}) of plagioclase feldspars. The major lattice mode vibrations appear to be diagnostic for respective members of the series; shifts of absorption bands of certain vibrations appear related to major element composition of feldspars. A linear plot of Na_2O content versus wave number indicates a shift of the 190 cm^{-1} albite peak to 215 cm^{-1} in anorthite (i.e., as Na_2O decreases, absorption shifts to shorter wave lengths). A strong log correlation between the same peak and the Al/(Al + Si) ratio is also indicated. With a decrease in Al/(Al + Si) there is a shift toward longer wave lengths, as expected from theory. Occurrence of major absorption bands within reasonably narrow wave-length limits helps in characterizing the spectra as a group. —*from* Author's abstract

03375 **Anson, Abraham.** Coasts and beaches—Infrared film from spacecraft, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. G15-G18, illus. [1969?].

The four Gemini photos, taken on infrared film, cover the Gulf Coast from Louisiana to Florida. The most significant feature is the "blooming" effect of the white streaks along the island beaches, due to the sand and oyster shells composing them.—ESL

03003 **Anstey, Robert L.; Perry, T. G.** Redescription of cotypes of *Peronopora vera* Ulrich, a Cincinnatian (Late Ordovician) ectoproct species: Jour. Paleontology, v. 43, no. 2, p. 245-251, illus., tables, 1969.

Redescription of the cotypes of the Cincinnatian (Late Ordovician) monticuliporid trepostome, *Peronopora vera* Ulrich, 1888, is necessitated by the inadequacy of the original description and the incompleteness of descriptions of hypotypes that have been presented by subsequent workers. Standard descriptive statistics of 16 measured taxonomic characters are given, representing 1,570 measurements that were obtained from five sectioned cotypes. The primary types of *P. vera* display larger zooecia than any other species of *Peronopora* and fewer of these structures in a 1-sq mm area. One of the cotypes, USNM 43943-2, is designated as lectotype and the remaining cotypes as paralectotypes. A single specimen that was illustrated as *P. vera* by Cumings and Galloway (1915) is reassigned to *P. decipiens* (Rominger).—*from* Authors' abstract

03280 **Aoki, Shinko.** Friction between mantle and core of the Earth as a cause of the secular change in obliquity: Astron. Jour., v. 74, no. 2, p. 284-291, illus., 1969.

It has been suggested that the discrepancy in the secular change of obliquity might be due to interaction between the mantle and core of the Earth. This changes our ideas as to what the inertial reference system really is. As a result, the velocity of galactic rotation, and therefore the mass of the galaxy, will be increased by factors of 1.5 and 3.5, respectively. It is calculated that a damping time for the friction of about 40 years is required, which geophysically is quite likely. Moreover, this solution implies

a drift of the core relative to the mantle of the order of the observed westward drift. —DBV

Aparicio G., Pablo. *See* James, David E. 03393

03094 **Armstrong, Augustus K.** Reply [to discussion by Elmer H. Baltz (1969) of "Interim report on Mississippian Arroyo Peñasco Formation of north-central New Mexico", 1967]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1518-1519, 1969.

Baltz (ibid., p. 1508-1518) generally refuses to accept age determinations, based on microfossils, for his lithic units in the Sangre de Cristo Mountains. The age determinations and their effect on the regional correlations are discussed briefly.—SEF

03418 **Armstrong, Baxter H.** Acoustic emission prior to rockbursts and earthquakes: Seismol. Soc. America Bull., v. 59, no. 3, p. 1259-1279, illus., 1969.

A semi-quantitative study has been carried out of the possibility of emission of acoustic strain and fracture radiation prior to earthquakes. Such emission has been observed in laboratory and mines. Theoretical estimates are derived of frequency of sound emitted by preliminary fracturing in a highly stressed region. Some emission should occur over high audible to low ultrasonic frequencies. Estimates of intensity of such emission lead to estimates of a very short transmission range with at best a marginal possibility of detection under certain favorable circumstances. However, increase in rock Q-values with pressure may lead to substantial increase in local transmission ranges within regions of high stress, which might permit practical observations of preliminary emission for shallow earthquakes whose strain fields extend to the surface.—*from* Author's abstract

Armstrong, Richard L. *See* Dasch, E. Julius. 03506

Arndt, Harold H. *See* Wood, Gordon H., Jr. 03637

03058 **Baars, D. L.** Major John Wesley Powell, Colorado River pioneer, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 10-18, illus., 1969.

02979 **Bachinski, Donald J.** Bond strength and sulfur isotopic fractionation in coexisting sulfides: Econ. Geology, v. 64, no. 1, p. 56-65, illus., tables, 1969.

"Bond strengths in sulfides are estimated from heats and free energies of formation, lattice energies, and other indirect, largely empirical methods." Sequences, from greatest to least enrichment in S-34, predicted from bond strength, are pyrite, sphalerite, chalcopyrite, galena; and pyrite, pyrrhotite, chalcopyrite, bornite, chalcocite. Where a reasonable amount of data exists, the systematic and consistent patterns in naturally occurring coexisting sulfides indicate an approach to isotopic equilibrium, and validate the use of estimates of bond strength to predict fractionation patterns among sulfides formed under equilibrium conditions.—WSW

03420 **Backus, George; Gilbert, Freeman.** Constructing P-velocity models to fit restricted sets of travel-time data: Seismol. Soc. America Bull., v. 59, no. 3, p. 1407-1414, illus., table, 1969.

A scheme recently proposed by Backus and Gilbert (1967) for constructing Earth models which fit a given finite set of gross Earth data is applied to the problem of constructing a P-velocity structure which, within experimental error, fits the observed traveltimes in the range $\Delta = 25°$ (5°) 95°. Three such models are obtained, all of which fit the observed traveltimes with residuals less than 0.06 sec, whereas 0.5 sec is the estimated standard error of the observations. The models differ mainly in the outer 700 km of the mantle.—Authors' abstract

03019 **Bada, Jeffrey Lee.** The reversible deamination of aspartic acid and its geochemical implications [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4086B-4087B, 1969.

03162 **Badger, William Barton.** Phase relations in the system Li_2O-Na_2O-Al_2O_3-SiO_2 with special emphasis on the silica polymorphs [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3695B, 1969.

Bailey, James S. *See* Psuty, Norbert P. 03374

03083 **Balakina, L. M.; Misharina, L. A.; Shirokova, E. I.; Vvedenskaya, A. V.** The stress state in earthquake foci and the elastic stress field of the Earth [with French abs.], *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 194-198, illus., table, 1969.

The stress state in earthquake foci and the Earth's elastic stress field with which earthquakes are associated are investigated by means of the analysis of the established regularities in the orientation of the principal axes of stresses active in the propagation of faults in the foci. The investigation has shown that in every investigated seismic region of the Earth either the greatest relative pressure or the greatest relative tension is horizontal and in the majority of regions normal to the trend of tectonic structures.—Authors' abstract

03301 **Ball, M. M.; Harrison, C. G. A.; Hurley, R. J.; Leist, C. E.** Bathymetry in the vicinity of the northeastern scarp of the Great Bahama Bank and Exuma Sound: Bull. Marine Sci., v. 19, no. 2, p. 243-252, illus., 1969.

The salient bathymetric features of the northeastern Great Bahama Bank are its steep escarpment, bordering the Atlantic Ocean, and the intraplatform basin, just west of this escarpment, known as Exuma Sound. Consideration of this region in the general context of the Florida-Bahamas carbonate province leads to the following conclusions: multiplicity of platform edges is commonplace; the pattern of platform facies is related to the position of the platform edge; intraplatform straits and basins are deeper and closer together in the direction of greater regional subsidence. A chain of cause and effect is suggested whereby structure controls platform topography which in turn influences currents and production of sediment.—Authors' abstract

03442 **Ballard, W. W.** Depositional environment of the Muddy formation [abs.]: Montana Acad. Sci. Proc. 1968, v. 28, p. 99, 1969.

03443 **Ballard, W. W.** Paleoenvironments and oil exploration [abs.]: Montana Acad. Sci. Proc. 1968, v. 28, p. 98, 1969.

03093 **Baltz, Elmer H.** Interim report on Mississippian Arroyo Peñasco Formation of north-central New Mexico—Discussion [of paper by A. K. Armstrong and L. D. Holcomb, 1967]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1508-1518, illus., 1969.

Baltz questions the fact that the conclusions of Armstrong and Holcomb (ibid., v. 51, no. 3, p. 417-424, 1967) are in marked variance with that of Baltz and Read (1960). Evidence regarding important points in the Armstrong and Holcomb paper are discussed and some evidence not discussed by these authors is presented.—SEF

Barghoorn, Elso S. *See* Eyde, Richard H. 03518

03353 **Barker, Daniel S.** A low-melting binary eutectic system for student experimentation: Jour. Geol. Education, v. 17, no. 3, p. 104, 1969.

Students in petrology and geochemistry courses tend to take phase diagrams on faith, rarely as interpretations. Many a solidus and liquidus should be portrayed by dashes, similar to concealed contacts on a geologic map. The system salol-thymol displays an analog to some simple but important binary silicate systems, and might permit student experimentation. Salol melts at 43°C and thymol at 51.5°C; the eutectic temperature lies between 0°C and 20°C at roughly equal weight proportions of salol and thymol. This makes possible a classroom demonstration of the mutual lowering of melting points of pure end members, to precede, or replace, student determination of the phase relations. Procedures with minimal equipment, as tried with a class of ten students, are given briefly.—GDC

03624 **Baroffio, James R.** N. E. I. A. B. (5150') Penn., *in* Oil and gas fields in West Texas. —Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 84-87, illus., 1969.

03070 **Barr, K. G.** Evidence for variations in upper mantle velocity in the Hudson Bay area, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 365-376, illus., table, 1969.

Arrivals at three permanent seismograph stations nearest to Hudson Bay are used to test the consistency of the time-term solutions that have been presented. Residuals from these solutions show a strong dependence on ray path, which could not have been deduced from temporary station data because of the shot-station geometry. First arrival data have been examined from the opposite point of view to time-term approach, i.e., with initial hypothesis that all residuals from a linear traveltime distance relation can be attributed to upper mantle velocity variations; this extreme hypothesis is surprisingly successful in explaining the data. The northern part of the Bay appears to have an upper mantle velocity (8.4-8.5 kmps) slightly higher than the remainder of the survey area (8.1-8.3 kmps). Time-term models published have ignored this effect and are probably seriously in error at the northern end of the Bay.—Author's abstract.

Bartlett, Alexandra. *See* Eyde, Richard H. 03518

Bateman, Paul C. *See* Zietz, Isidore. 03483

03528 **Bauleke, Maynard P.; Hornbaker, Allison L.** Attrition scrubbing and flotation beneficiation of Cheyenne Sandstone (Lower Cretaceous, Kansas), *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 13-14, illus., tables, 1969.

Acidic attrition scrubbing reduced the iron oxide (Fe_2O_3) content of Cheyenne Sandstone to less than 0.040 percent. No significant improvement was obtained by an additional flotation treatment. Sand usage appears limited to foundry sand, abrasive sand, and low-quality glass sand.—Authors' abstract

03529 **Bauleke, Maynard P.; Huh, John M.** Thermal expansion of Kansas volcanic ash, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 15-16, illus., table, 1969.

Thermal expansion values of Kansas volcanic ash range from 4.05 to 4.65 $\times 10^{-6}$/C° (100-650°C), varying with chemical composition. The softening point is above 900°C.—Authors' abstract

Bauleke, Maynard P. *See* Hladik, William B. 03530

03476 **Bayliss, Peter.** Isomorphous substitution in synthetic cobaltite and ullmannite: Am. Mineralogist, v. 54, nos. 3-4, p. 426-430, illus., table, 1969.

Synthetic cobaltite shows a continuous solid substitution from $CoAs_{0.80}S_{1.19}$ to $CoAs_{0.42}S_{1.58}$ at 500 °C. Syntheses of Ni(Sb, As, S)$_2$ and (Ni, Co)SbS indicate that corynite is antimonian gersdorffite and willyamite is cobaltian ullmannite, and further use of these varietal names is unnecessary.—Author's abstract

03188 **Beal, Miah Allan.** Bathymetry and structure of the Arctic Ocean [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3853B-3854B, 1969.

Beall, A. O., Jr. *See* Burk, C. A. 03107

03100 **Beaver, H. R.** Willis D. Waterman (1925-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1526-1527, portrait, 1969.

03413 **Beaver, J. A.; Frankel, M. L.** Significance of ground-water management strategy. —A systems approach: Ground Water, v. 7, no. 3, p. 22-26, 1969.

In San Bernardino Valley, southern California, a unique experiment is being performed—the application of systems analysis technology to water resource management. The organization is formed by a combination of contracts and cooperative agreement between private and government agencies. The result is a favorable environment for development of effective water resource management strategies. San Bernardino Valley is similar to many areas where water resource management reduces to the allocation of locally available ground water and potential imported water resources. This paper outlines in detail the analysis tools and long-range planning needs of effective ground-water management strategies.—*from* Authors' abstract

Becker, A. *See* Slankis, J. A. 03650

03025 **Beckham, Wallace Edgar, Jr.** Electrical polarization in carbonate rocks [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4223B, 1969.

03103 **Beebe, B. W.** Ralph Emerson Davis (1884-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1523-1524, portrait, 1969.

03502 **Beerbower, J. R.** Interpretation of cyclic Permo-Carboniferous deposition in alluvial plain sediments in West Virginia: Geol. Soc. America Bull., v. 80, no. 9, p. 1843-1847, illus., 1969.

Extensive road cuts along Interstate Highway 77 north of Charlestown, West Virginia, provide exposures of lateral variation in the upper Monongahela and lower Dunkard Groups (Permo-Carboniferous). The limited lateral extent of individual lithologies and of the cyclothems they define demonstrate that the cyclicity is of local (autocyclic) origin generated primarily by infrequent diversion of the main channel belt and secondarily by periodic crevassing and lateral migration of the channel belt. No evidence appears for external (allocyclic) generation of cyclicity by eustatic, tectonic or climatic mechanisms.—Author's abstract

03344 **Beger, Richard M.** The crystal structure and chemical composition of pollucite [with German abs.]: Zeitschr. Kristallographic, v. 129, nos. 1-4, p. 280-302, illus., tables, 1969.

The structure of pollucite from Rumford, Maine, has been determined and refined. The space group is *Ia3d* with cell edge $a = 13.69$ A. The structure was investigated using 213 independent reflection intensities measured on a single crystal diffractometer. Pollucite has analcime framework with cesium atoms occupying the large voids in the framework. Water molecules occupy the large voids not occupied by cesium. Sodium atoms are located in equipoint 24c at 1/4 1/8 0, in the positions between water molecules. The water molecules and sodium atoms occupy the same positions as they do in analcime, but occur only in randomly distributed clusters of atoms whose outer members are restricted to water molecules. The final structure was refined by least squares to an R value of 0.050 for all reflections.—*from* Author's abstract.

02983 **Bell, Bruce M.; Frey, Robert W.** Observations on ecology and the feeding and burrowing mechanisms of *Mellita quinquiesperforata* (Leske): Jour. Paleontology, v. 43, no. 2, p. 553-560, illus., table, 1969.

The scutellid echinoid *M. quinquiesperforata* is abundant on most littoral and sublittoral sandy substrates along the southeastern Atlantic and northern Gulf coasts, and is common in Pleistocene deposits of those areas. Its feeding and burrowing activities substantially modify the substrate and thus have considerable paleoecological and sedimentological significance. Field and laboratory studies at Beaufort, N.C., have revealed that during feeding the sand dollar size-sorts the detrital grains, ingesting the finer sand particles, then passing these upward through the posterior lunule, and moving the coarser grains to the borders of its trail. In burrowing, the echinoid tends to glide between sediment layers, but the fabric of the overlying sand is disrupted by vertical displacement and collapse; in more viscous substrates, the upper layer is disrupted horizontally as well.—VMJ

03326 **Bennett, J. M.; Smith, J. V.** Positions of cations and molecules in zeolites with the faujasite framework—[Pt.] 6, Hydrated La-exchanged faujasite: Materials Research Bull., v. 4, no. 6, p. 343-348, 1969.

Hydrated La-exchanged faujasite has a similar cation distribution to that of hydrated Ca-exchanged faujasite, differing only in observed occupancy of the sites. Hence the cation distribution is probably governed by simple ionic rules.—Authors' abstract

Berg, Eduard. *See* Gedney, Larry. 03422

03049 **Berger, Wolfgang Helmut.** Planktonic foraminifera—Shell production and preservation [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4301B, 1969.

03166 **Bergeron, William Joseph.** Finite element analysis of salt pillar models [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3771B, 1969.

Berggren, W. A. *See* Burk, C. A. 03107

Bermúdez, Pedro J. *See* Seiglie, George A. 03274

Berry, A. W. *See* Anderson, Jay Earl, Jr. 03507

03469 **Berry, L. G.** Memorial of Robert Mitchell Thompson—July 28, 1918-April 15, 1967: Am. Mineralogist, v. 54, nos. 3-4, p. 649-652, portrait, 1969.

03106 **Berry, William B. N.** Middle Devonian dendroid graptolites from the central United States: Jour. Paleontology, v. 43, no. 3, p. 705-711, illus., 1969.

Dendroid graptolites are described of late Middle Devonian (Givetian) age that are associated with shelly faunas. These graptolites are: *Desmograptus* sp. 1 and *Dictyonema* sp. from the "Cedar Valley Limestone" near Kritesville, Illinois; *Desmograptus* sp. 3 from the Rapid Member of the Cedar Valley Limestone near Linwood, Iowa; *Desmograptus* sp 2 from the Alpena Limestone at Alpena, Michigan; and *Dictyonema gorbutensis* n.sp. from the Gravel Point Formation in Cheboygan County, Michigan.—Author's abstract

Berry, William B. N. *See* Carlson, Marvin P. 03116

03052 **Beus, Stanley S.** Devonian stratigraphy in northwestern Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 127-133, illus., 1969.

Devonian rocks are absent east of Winslow but thicken to almost 1300 ft in northwestern Arizona. The lithology consists almost entirely of dark to light gray, aphanitic to coarse grained dolomite with minor amounts of interbedded limestones and shales. Terrigenous sediments increase in quantity eastward as the total Devonian thickness decreases. Fossil remains are abundant in the Devonian of central Arizona but apparently are progressively less common north and west of Jerome. Most Devonian sediments accumulated over a broad, shallow, marine shelf or craton bordering a miogeosyncline to the west. The shelf subsided uniformly and slowly except in extreme northwestern Arizona. An isopach map defines an intracratonic basin centered on the Iceberg Canyon area of Lake Mead where 1300 ft of sediments accumulated.—KAF

03120 **Beus, Stanley S.; Lane, N. Gary.** Middle Pennsylvanian fossils from Indian Springs, Nevada: Jour. Paleontology, v. 43, no. 4, p. 986-1000, illus., 1969.

The brachiopods (24 species, 5 new) and one new gastropod species from a large invertebrate fauna from the Middle Pennsylvanian (Desmoinesian Series) part of the Bird Spring Formation near Indian Springs, Clark County, Nev., are described. Several of the species attain large size. All were collected from a single locality in a stratigraphic interval of about 20 feet. The new brachiopod species are: *Retaria pseudantiquatonia*, *Calliprotonia spinula*, *Buxtonia websteri*, *Choristites orbitus*, and *Punc-*

tospirifer gnomus; the gastropod is *Peruvispira boreala* n.sp. The fauna is correlated with the Moscovian (Middle Carboniferous) of Russia and Pennsylvanian of north-central Texas.—*from* Authors' abstract

Bickford, M. E. *See* Anderson, Jay Earl, Jr. 03507

03090 **Biederman, E. W., Jr.** Significance of high-wax oils with respect to genesis of petroleum—Commentary [on paper by H. D. Hedberg, 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1500-1502, 1969.

The author presents ideas supporting Hedberg's (ibid., v. 52, no. 5, p. 736-750, 1968) contention that high-wax oils may have been derived from plant sources deposited in environments of less-than-normal marine salinity. He additionally proposes that shoreline systems are possible sources and reservoirs for such high-wax oils. The majority of high-wax oils are found in Devonian and younger rocks, after land plants had become abundant in Devonian time.—SEF

03131 **Bilelo, Maria M.** Fusulinidae of the Winchell Formation (Pennsylvanian), north-central Texas: Jour. Paleontology, v. 43, no. 3, p. 688-704, illus., table, 1969.

Study of the Fusulinidae of the Winchell Formation in Palo Pinto, Stephens, and Wise Counties, Texas, reveals the presence of six species in nine collections from nine localities: *Triticites ohioensis* Thompson, *T. oryziformis* Newell, *T. primarius* Merchant and Keroher, *T. heroyi* n. sp., *T. ferayi* n.sp., *T. winchellensis* n. sp. The fauna is most closely comparable to that of the mid-Missourian Series, indicating equivalency in age with the Pennsylvanian standard section strata of the Mid-Continent region, although *T. ferayi* is suggestive of species appearing in late Virgilian and Early Permian rocks.—*from* Author's abstract

03306 **Bilelo, Maria M.** The fossil fish *Lepidotes* in the Paluxy Formation, north-central Texas: Am. Midland Naturalist, v. 81, no. 2, p. 405-411, illus., tables, 1969.

Study and reconstruction of disarticulated bones of a fish recovered from the Paluxy Formation of the Trinity Group (Albian) in Wise County, Texas, reveal that the characters shown in the dermal elements of the skull, dentition and squamation agree with typical characteristics of the semionotid fish genus *Lepidotes*. Because of the incomplete nature of the specimen it is referred to *Lepidotes* sp. Superficially it bears a closer resemblance to *L. mantelli* Agassiz of Lower Cretaceous strata than to any other species but it also has a surprising number of characters in common with Upper Triassic species. The nature of its dentition suggests that it fed on mollusks in a freshwater environment.—Author's abstract

03470 **Billhardt, H. W.** Synthesis of lead pyrosilicate and other barysilite-like compounds: Am. Mineralogist, v. 54, nos. 3-4, p. 510-521, illus., tables, 1969.

In the binary system PbO-SiO^2 the compound $Pb_3Si_2O_7$ was synthesized. Indexed X-ray powder and single crystal data as well as optical and IR data show that $Pb_3Si_2O_7$ is the Pb-analogue of the mineral barysilite $Pb_8Mn(Si_2O_7)_3$. To elucidate the barysilite formula Pb in $Pb_3Si_2O_7$ has been partially replaced by Mn, Mg, Ca, Sr and Ba. A Pb-Sr-Ba-mixed crystal was synthesized which is isotypic but not isomorphic to natural barysilite. This Pb-Sr-Ba-"barysilite" probably has the formula $Pb_8(Pb, Sr, Ba)(Si_2O_7)_3$. The ternary compound $2PbO \times MgO \times 2SiO_2$ found by Argyle and Hummel (1965-66) in the system PbO-MgO-SiO_2 was shown to be a Mg-"barysilite" of the composition $Pb_8Mg(Si_2O_7)_3$.—Author's abstract

03053 **Bissell, H. J.** Permian and Lower Triassic transition from the shelf to basin (Grand Canyon, Arizona to Spring Mountains, Nevada), *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 135-169, illus., 1969.

Shelf rocks of Permian age are included in the upper Supai, Esplanade and Queantoweap, Hermit, Coconino, Toroweap and Kaibab formations. Permian and Lower

Triassic rocks in the area transitional from the east, in a westerly direction undergo substantial facies changes. Permian rocks between the South Hurricane Cliffs and the Las Vegas hinge line include the Pakoon, Queantoweap, Hermit, Coconino, Toroweap, and Kaibab. West of the Las Vegas hinge line, most units of the Permian and Lower Triassic change facies, and some members and formations thicken at the expense of others. In the upper plate of the Keystone overthrust, Callville and Pakoon are replaced laterally by the Bird Spring Group, overlain in succession by carbonates and clastics, with the Toroweap and Kaibab progressively thinning. The latter two formations are eventually cut out by Lower Triassic conglomerates.—KAF

03050 **Blake, J. Roger.** The influence of coastal and sea floor geometry on natural electromagnetic variations of 10^{-4} to 10^{3} Hz [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4307B, 1969.

03409 **Blankenship, John.** Salt tectonics—Mechanics of diapirism [abs.]: Houston Geol. Soc. Bull., v. 11, no. 8, p. 33, 1969.

03542 **Bloom, Arthur L.** The surface of the Earth: Englewood Cliffs, N. J., Prentice-Hall (Found. Earth Sci. Ser.), 152 p., illus., tables, 1969.

This textbook explains how the Earth's surface achieved its present form, and changed within man's lifetime, and how landscapes are shaped. Chapter headings are: energetics of the Earth's surface, rock weathering, rock fragments in motion, streams and channels, life history of landscapes, edges of the land, and ice on the land. Two themes are stressed: landforms tend to develop in equilibrium with processes that shape them, and sediments in transport through eroding landscapes serve as shock absorbers to weak energy inputs and permit balanced states to be developed and maintained in systems of declining energy supply.—*from* Author's introduction

03001 **Boardman, Richard S.; Cheetham, Alan H.** Skeletal growth, intracolony variation, and evolution in Bryozoa—A review: Jour. Paleontology, v. 43, no. 2, p. 205-233, illus., table, 1969.

Inferences about mode of growth in those groups of Bryozoa important in the fossil record are made from microstructure of zooecia and zoaria; from the geometric arrangements, morphology, and gradients of morphologic change of zooecia positioned within the zoarium; and from extrapolated relationships between skeletal and soft tissues in related Holocene species. Inferences about evolutionary trends and phylogenetic lineages are made through isolating the genetically controlled parts of variation in these phenetic features and placing the populations that exhibit them in their relative time-space sequence.—RCD

03064 **Bolt, Bruce A.** (and others). The safety of fills, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 119-130, tables, 1969.

This report deals with the safety of fills in the San Francisco Bay. For earth fills over bay deposits or other natural weak soils, major hazards to be considered in addition to ground shaking include subsidence and settlement due to consolidation or compaction, landslides due to various causes, and liquefaction. There is a wide range of hazards and risks to life and property on bay fills. The recommended approach is to classify these risks by zones and occupancies. Geological and seismological considerations related to construction and the studies required before building on bay fills are discussed.—KAF

03451 **Bonattti, Enrico; Joensuu, Olva.** Palygorskite from the deep sea—A reply [to 1969 discussion by G. Sabatier of 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 568, 1969.

The authors regret that they failed (ibid., v. 53, p. 975-983) to quote the discovery of palygorskite from the Red Sea and Gulf of Aden (Heezen et al, 1965). If their hydrothermal origin hypothesis is correct, more authigenic Mg-silicates of the pa-

lygorskite-sepiolite group will be found frequently in sediments associated with active ridges and fracture zones (discussion, ibid., v. 54, nos. 3-4, p. 568).—ESL

02993 **Boneham, Roger F.** Middle Devonian (Erian) chitinozoan casts from Silica, Lucas County, Ohio: Jour. Paleontology, v. 43, no. 2, p. 527-528, illus., 1969.

Internal casts of chitinozoans are reported for the first time. The specimens were found in a limy shale unit of the Middle Devonian Silica Formation near Silica, Ohio.—SHM

Bonnichsen, Robson. *See* Hopkins, Marie L. 03553

03141 **Boos, Margaret Fuller.** Ultramafic dike complex in Precambrian, Storm Mountain, Larimer County, Colorado [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 29, 1969.

03429 **Born, S. M.; Stephenson, D. A.** Hydrogeologic considerations in liquid waste disposal: Jour. Soil and Water Conserv., v. 24, no. 2, p. 52-55, illus., 1969.

Well managed ridge-and-furrow irrigation and mobile spray-irrigation for disposal of liquid wastes are satisfactory methods, with potential benefits of fertilizing land and augmenting ground-water recharge. Geological conditions that control infiltration, flow, and storage of effluent must be evaluated; costs are far outweighed by consequences of inadequate planning. Favorable sites allow man, by renovation practices, to supplement natural purification. Interconnection of ground-water systems and surface-water bodies is recognized. Infiltration capacity is variably influenced by climate, rock type and weathering, and soil saturation. Permeability is often greater along bedrock fractures, surface patterns of which may be traced in the field or on airphotos. Source of pollution in deep fractures and solution channels, such as in carbonate and volcanic terrane, is harder to locate.—GDC

03088 **Bornhauser, Max.** Geology of Day Dome (Madison County, Texas)—A study of salt emplacement: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1411-1420, illus., 1969.

Day Dome is believed to have developed from salt furnished from a salt anticline, now the site of a trough-like depression. Growth by downbuilding and extrusive flow of salt may explain the absence of drag in flanking beds and presence of thick anhydrite caprock. The top of the salt core remained continuously near the depositional surface until the time of Wilcox deposition. Subsequent growth was minor and finally ceased because of increased and rapid sedimentary loading, salt solution, and diminishing salt supply. During growth of the dome, strength of competent Mesozoic flanking rocks inhibited intrusive movement of salt and drag effects.—EGS

03598 **Bosschart, R. A.** Applications and limitations of airborne electromagnetic systems in mineral exploration: Mining in Canada, May 1969, p. 19-28, illus., 1969.

Complex component measuring rigid boom systems such as the Mullard system and the helicopter systems, and towed bird systems of airborne electromagnetic surveying have won general acceptance both on technical and economic grounds. It would seem questionable whether the recent revival of two frequency imaginary component systems will last, in view of their limited detection capability. The VLF prospecting systems will contribute confusion rather than any tangible benefits to mineral exploration. There is a good case for paying a premium dollar for a premium AEM system. If the present rate of discovery of new ore bodies is to be increased, existing systems must be refined and new and more effective techniques added.—KAF

02972 **Bostock, Hewitt H.** Precambrian sedimentary rocks of the Hudson Bay Lowlands, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 206-214, illus., 1969.

Reconnaissance mapping by the Geological Survey of Canada during 1967 has extended known areas of Precambrian sedimentary rocks west of Churchill, Manitoba,

and in Cape Henrietta Maria area, Hudson Bay Lowlands. In the Churchill area coarse- to fine-grained clastic sediments form an east-west belt extending through Churchill and probably continuous beneath Paleozoic cover with similar rocks exposed to the west. In the Cape Henrietta Maria area Precambrian sedimentary rocks including iron formation are exposed in a narrow discontinuous southeast trending belt extending from Winisk River to near James Bay and in an inlier on Aquatuk River. Elsewhere over the Cape Henrietta Maria Arch, Paleozoic cover is believed thin or absent. Similar Precambrian rocks extend across the mouth of James Bay and probably continue west beneath Paleozoic rocks beyond the Winisk inlier.—*from* Author's abstract

Bottino, Michael L. *See* Fullagar, Paul D. 03501

Boucot, A. J. *See* Walmsley, V. G. 02960

03543 **Bouma, Arnold H.** Methods for the study of sedimentary structures: New York, Wiley-Interscience, 458 p., illus., tables, 1969.

Among the methods described are various techniques using different types of adhesives for removing a thin layer of material from the surface of unconsolidated or consolidated sediments, impregnation methods, and X-ray radiography. Other methods are also described, and several chapters are devoted to instrumentation and sampling. An extensive bibliography and author and subject indexes are appended.—MS

Bower, Margaret. *See* Hood, Peter. 03075

03154 **Brabb, Earl E.** Six new Paleozoic and Mesozoic formations in east-central Alaska: U.S. Geol. Survey Bull. 1274-I, p. I1-I125, illus., tables, 1969.

Six of 25 new map units established by regional geologic mapping in the Charley River and Eagle quadrangles are formally defined and named as follows: Ford Lake Shale (Upper Devonian to Upper Mississippian), Step Conglomerate (Permian), Glenn Shale (Middle Triassic to Lower Cretaceous), and the Keenan Quartzite, Biederman Argillite, and Kathul Graywacke—three formations within the Lower Cretaceous Kandik Group.—Author's abstract

03347 **Brady, B. T.** A statistical theory of brittle fracture for rock materials—Pt. 2, Brittle failure under homogeneous triaxial states of stress: Internat. Jour. Rock Mechanics and Mining Sci., v. 6, no. 3, p. 285-300, illus., 1969.

The critical volumetric microcrack strain criterion outlined in Part I [ibid., v. 6, no. 1] is extended to include total failure of brittle materials deformed under a condition of homogeneous triaxial loading. The criterion indicates that the fracturing characteristics of brittle rock materials are influenced by the value of the intermediate principal stress. The influence of material heterogeneity upon the fracture characteristics of brittle rock is discussed. The analysis indicates that the failure envelope is nonlinear and that the degree of nonlinearity tends to diminish as the confining pressure is increased.—*from* Author's abstract

03348 **Brady, B. T.** The nonlinear mechanical behavior of brittle rock—Pt. 2, Stress-strain behavior during regions III and IV: Internat. Jour. Rock Mechanics and Mining Sci., v. 6, no. 3, p. 301-310, illus., 1969.

The results of a theoretical investigation of the stress-strain properties of tight brittle rock undergoing local failure (microcracking) during regions III and IV are discussed. The microcracking process is approximated by a system wherein ellipsoidal-like voids are opening spontaneously as the applied stresses are increased above a critical level. The mathematical format of the strains due to microcracking is chosen so that only finite values of strain are permitted except at total failure. It is shown that the variation in the apparent moduli with applied stress is in accord with published experimental data.—Author's abstract

Brady, Michael J. *See* McCubbin, Donald G. 03078

03575 **Bray, E. E.; Evans, E. D.** Organic extracts from JOIDES cores off northeastern Florida: U.S. Geol. Survey Prof. Paper 581-C, p. C1-C7, illus., tables, 1969.

Extracts of samples from cores of Tertiary strata at six sites off the Atlantic coast of northern Florida and across the Blake Plateau contained very meager quantities of hydrocarbons and other soluble organic material. Eleven samples forming a group with the least carbonate content from the shelf and continental slope were available for hydrocarbon analyses. In five of these samples from depths less than 25 m below the ocean floor, the smaller molecular sizes, ranging from C_{12} to C_{20} averaged 22.1 percent of the saturated hydrocarbons (C_{12}-C_{30}), whereas in the remaining six samples from greater depths, this fraction averaged 36.5 percent.—Authors' abstract

03061 **Breed, Carol S.** A century of conjecture on the Colorado River in Grand Canyon, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 63-67, illus., 1969.

Conjecture on the Colorado River in the Grand Canyon has centered about three aspects of the problem: (1) the relation of the river to structural features, (2) the physiographic contrast between widely stripped plains of the surrounding plateau and the deep, narrow canyons in which the river runs, and (3) the frustrating scarcity of Cenozoic strata (in Arizona) whose history might be related to that of the river.—KAF

03056 **Breed, William J.** The discovery of orthocone nautiloids in the Redwall Limestone, Marble Canyon, Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 134, illus., 1969.

An orthocone nautiloid, *Rayonnoceras* sp., was discovered in the Redwall Limestone along a small tributary of the Colorado River on the east side of the Marble Canyon near Milepost 35.—KAF

Breed, William J. *See* Ford, Trevor D: 03057

02998 **Bretsky, Peter W.; Flessa, K. Walter; Bretsky, Sara S.** Brachiopod ecology in the Ordovician of eastern Pennsylvania: Jour. Paleontology, v. 43, no. 2, p. 312-321, illus., 1969.

A sandstone member of the Martinsburg Formation which caps the 8-mile-long Shochary Ridge contains an abundant fauna composed almost entirely of strophomenid and orthid brachiopods, which apparently lived in a quiet-water shelf environment. The eastern, south-central and north-central flanks of the ridge contain mainly strophomenids, dominated by *Sowerbyella* (*Sowerbyella*) *sericea*; the central and western parts, with muddier sediments, contain mainly orthids, dominated by *Onniella? multisecta*, although there is considerable mixing of the two dominant types.—REG

03026 **Bretsky, Peter William, Jr.** Upper Ordovician ecology of the central Appalachians [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4223B-4224B, 1969.

Bretsky, Sara S. *See* Bretsky, Peter W. 02998

03381 **Bright, E. G.** Timmins district, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 3: Ontario Dept. Mines Misc. Paper 25, p. 13-33, illus., 1969.

During 1968, seven gold mining operations and four base-metal mining operations were active. Two gold mines, Hollinger and Preston, terminated operations in the year and the Munro copper mine, which ceased mining operations is re-evaluating its ore reserve position. Re-evaluation also commenced on the former Genex copper mine in Godfrey Township. Development continued on four new potential producers, one copper-zinc, one columbium and three asbestos. Approximately 3,935 mining claims were recorded in the Porcupine Mining Division, an increase of about

1,000 claims over last year. Those parts of the Larder Lake, Sault Ste. Marie and Sudbury Mining Divisions in the Timmins district showed a decrease in the number of claims recorded. The majority of the staking and exploration activity was in the immediate Timmins area and the areas northwest and northeast of Kidd Township.—Author's summary

03617 **Britt, Terrence L.** North Crossett (Devonian), *in* Oil and gas fields in West Texas.—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 52-56, illus., 1969.

Brockett, E. D. *See* National Petroleum Council. 03526

03487 **Brooks, H. K.** (and others). Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, Crustacea (except Ostracoda), Myriapoda, Hexapoda, V. 1-2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), V. 1, p. R1-R398, illus., tables, 1969; V. 2, p. R399-R651, illus., table, 1969.

Part R consists of 3 volumes; in V. 1-2, the superclasses Crustacea (except Ostracoda, which occupies Pt. Q, 1961) and Myriapoda are treated; V. 3, to be published later, will contain superclass Hexapoda, including Insecta, by F. M. Carpenter. Sixteen sections are cited separately: classification of arthropoda; evolution . . . of Onychophora, etc.; general features of Crustacea; sections on 8 crustacean classes, a superfamily, and an order; Myriapoda; myriapodan, class Arthropleurida; Arthropoda incertae sedis. Senior authors of the sections are: S. M. Manton (2), R. C. Moore (2), R. R. Hessler (3), P. Tasch, A. R. Palmer, W. A. Newman, H. K. Brooks, M. F. Glaessner, G. Hahn, R. L. Hoffman, W. D. I. Rolfe (2).—VMJ

03492 **Brooks, H. K.; Glaessner, M. F.; Hahn, Gerhard; Hessler, R. R.; Holthuis, L. B.; Manning, R. B.; Moore, R. C.; Rolfe, W. D. I.** Malacostraca, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1-2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), V. 1, p. R295-R398, illus., 1969; V. 2, p. R399-R566, illus., table, p. R626-R628 (addendum to Decapoda), 1969.

Malacostraca constitute the largest class of Crustacea, except for Ostracoda, and probably the most diverse in form and size. Morphology, ecology, phylogeny, classification, descriptions, and geologic occurrence are treated in sections by different authors for each major group. The class contains two subclasses, Phyllocarida, with bivalved carapace (Cambrian-Holocene, 4 orders, 52 genera described) and Eumalacostraca, nonbivalved carapace (Devonian-Holocene, 534 genera described) with 5 superorders, the largest, Eucarida, with orders Euphausiacea (no fossils) and Decapoda (Permotriassic-Holocene, 421 genera described). Malacostraca are considered monophyletic in origin because of the rigid plan of tagmosis and consistent position of genital openings, and many morphological features in common.—VMJ

Brooks, Robert R. *See* Whitehead, Neil E. 02978

03054 **Brown, J. William.** Stratigraphy and petrology of the Kaibab Formation between Desert View and Cameron, northern Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 170-173, illus., 1969.

Rocks of the Kaibab between Desert View and Cameron are calcareous sandstone, sandy limestone, dolomite and bedded chert. The Beta Member, including Facies 3 and 4, and the Alpha Member, including Facies 2 and 3 crop out in this area. The contact between Alpha and Beta Members of the Kaibab is based on a change from rocks deposited during steady stand to those deposited during regression of the sea. Very fine-grained quartz arenite is by far the most abundant sandstone type in the Kaibab. Carbonate rocks form the greatest part of theKaibab Formation and are mostly microsparite. Terrigenous sand forms a high percentage of most of the carbonate rocks. Cross-strata show that transport was from the north. Poorly preserved fossils are abundant in all but two of the sections studied, and consist largely of molds and casts of pelecypods.—KAF

03411 **Bruington, A. E.** Control of sea-water intrusion in a ground-water aquifer: Ground Water, v. 7, no. 3, p. 9-14, illus., 1969.

Sea-water intrusion into ground-water reservoirs occurs when permeable formations outcrop into a body of sea water and when there is a landward gradient. Intrusion can be controlled by reducing pumping, by increasing supply, or by forming some type of barrier. A pressure barrier has been operated in Los Angeles County, Calif. Special facilities are needed. Costs of operation are high.—Author's abstract

Bryant, Bruce. *See* Obradovich, John D. 03456

03639 **Bryant, Bruce.** Geologic map of the Maroon Bells quadrangle, Pitkin and Gunnison Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-788, scale 1:24,000, sections, 1969.

Bryson, Reid A. *See* Moran, Joseph M. 03338

Buckley, Jane T. *See* Ives, Jack D. 03337

Buckley, Jane T. *See* King, Cuchlaine A. M. 03339

Bukry, D. *See* Burk, C. A. 03107

03538 **Burchett, Raymond R.** (compiler). Geologic bedrock map of Nebraska: [Lincoln, Nebr.] Univ. Nebraska Conserv. and Survey Div., scale 1:1,000,000, section, 1969.

03354 **Burger, H. Robert.** A plea for changes in undergraduate structural geology courses: Jour. Geol. Education, v. 17, no. 3, p. 101-103, 1969.

Current trends and research in structural geology depend more and more upon fundamental principles of rock mechanics. To discover the emphasis given them in lectures and laboratories of undergraduate courses in structural geology, 117 questionnaires were sent to a random selection of colleges and universities that offer a major in geology. In 73 replies, only 23 included reports on laboratory exercises; a few interesting ideas are summarized. Impressive is the need for more concentration on basic principles of rock deformation, in simpler structures than those of igneous and metamorphic rocks, especially in experimental laboratory time; consideration of advanced tectonics could be deferred.—GDC

03107 **Burk, C. A.; Ewing, M.; Worzel, J. L.; Beall, A. O., Jr.; Berggren, W. A.; Bukry, D.; Fischer, A. G.; Pessagno, E. A., Jr.** Deep-sea drilling into the Challenger Knoll, central Gulf of Mexico: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1338-1347, illus., table, 1969.

A core hole in the Sigsbee Knolls area encountered salt-dome caprock saturated with oil, gas, and sulfur more than 12,000 feet below sea level. Sigsbee Knolls and adjacent buried domes are interpreted to be diapirs derived from mid-Mesozoic salt deposits which are comparable with other major evaporite sequences in the Gulf region. Data indicate that the sulfur-rich, low-gravity oil is of fairly young age and derived from marine organic material. Pelagic clays and calcareous oozes above the caprock, and the turbidite-rich sequence in the adjacent abyssal plain appear to reflect major late Cenozoic events in the land area surrounding the Gulf.—*from* Authors' abstract

03517 **Butler, B. Robert.** More information on the frozen ground features and further interpretation of the small mammal sequence at the Wasden Site (Owl Cave), Bonneville County, Idaho: Tebiwa, v. 12, no. 1, p. 58-63, illus., 1969.

Three zones of ice-wedge features show three intervals of climatic change. They were not long enough, however, to have influenced the small mammal population of the area. One zone overlies Mazama Ash (6600 B.P.), and one just below the ash is younger than 7750 years; the oldest is about 8000 B.P. Above the upper wedge the increase in rabbit and decrease in pocket gopher suggests a modest but significant

ecological change in the area. The ice-wedge features suggest a colder, more variable climate.—HRC

03445 **Cabri, L. J.** Density determinations—Accuracy and application to sphalerite stoichiometry: Am. Mineralogist, v. 54, nos. 3-4, p. 539-548, illus., 1969.

A hydrostatic method of determining density has been developed which attains a precision of 0.06 percent and an accuracy of about 0.1 percent (within 2 standard deviations) for 90 to 120-mg samples having a density of 4.0 g cm^{-3}. This method uses a Cahn RG electrobalance and practical-grade hexachloro-1, 3-butadiene (ρ=1.67076 g cm^{-3} at 25°C). Sulfides frequently exhibit variations in stoichiometry that may be quantitatively examined by precise density determinations. Application of density determinations to a study of the stoichiometry in synthetic, polycrystalline, iron-bearing sphalerites, shows that, if Fe^{3+} occurs in interstitial sites, as has been suggested, then it must represent less than 1 percent of the amount of Fe present.—Author's abstract

03340 **Caine, N.** The analysis of surface fabrics on talus by means of ground photography: Arctic and Alpine Research, v. 1, no. 2, p. 127-134, illus., tables, 1969.

A method for measuring the orientation fabric of coarse surface material by photographic means is described. On the two talus slopes where this method has been applied, the results obtained are comparable with those due to field measurement, and support earlier findings of isotropic fabrics on the surface of talus slopes. These fabrics are interpreted as a response to random processes of talus accumulation and creep and suggest that particles are moved as single units rather than en masse.—Author's abstract

03299 **California Div. Mines and Geology.** Dear Division: California Div. Mines and Geology Mineral Inf. Service, v. 22, no. 5, p. 75-81, illus., 1969.

The California Division of Mines and Geology has received numerous inquiries regarding earthquakes in the state. Answers to the most common questions are summarized, with emphasis on phases of earthquake information that are still not certain.—CDC

Callahan, James E. *See* Wanek, Alexander A. 03431

03006 **Campbell, J. A.** Upper Valley oil field, Garfield County, Utah, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 195-200, illus., table, 1969.

The Upper Valley field, the only commerical oil field in the Kaiparowits Basin of south-central Utah, is located near the crest of the Upper Valley anticline. The reservoir at Upper Valley occurs adjacent to the Permo-Triassic unconformity. The reservoir rocks are the Kaibab Limestone (Permian) and carbonates of the Timpoweap Member of the Moenkopi Formation (Triassic). The principal production is from the two persistent porous zones in the Beta Member of the Kaibab Limestone.—KAF

03191 **Canada Geological Survey.** Aeromagnetic series, Étamamiou, Quebec: Canada Geol. Survey Geophysics Paper 5123, scale 1:63,360, 1969.

03192 **Canada Geological Survey.** Aeromagnetic series, Lac Coacoachou, Quebec: Canada Geol. Survey Geophysics Paper 5124, scale 1:63,360, 1969.

03193 **Canada Geological Survey.** Aeromagnetic series, Lac Washicoutai, Quebec: Canada Geol. Survey Geophysics Paper 5125, scale 1:63,360, 1969.

03194 **Canada Geological Survey.** Aeromagnetic series, Lac Kégashka, Quebec: Canada Geol. Survey Geophysics Paper 5126, scale 1:63,360, 1969.

03195 **Canada Geological Survey.** Aeromagnetic series, Lac Paimpont, Quebec: Canada Geol. Survey Geophysics Paper 5127, scale 1:63,360, 1969.

03196 **Canada Geological Survey.** Aeromagnetic series, Lac Cugnet, Quebec: Canada Geol. Survey Geophysics Paper 5132, scale 1:63,360, 1969.

03197 **Canada Geological Survey.** Aeromagnetic series, Lac Allard, Quebec: Canada Geol. Survey Geophysics Paper 5133, scale 1:63,360, 1969.

03198 **Canada Geological Survey.** Aeromagnetic series, Lac de la Robe-Noire, Quebec: Canada Geol. Survey Geophysics Paper 5134, scale 1:63,360, 1969.

03199 **Canada Geological Survey.** Aeromagnetic series, Lac Michaud, Quebec: Canada Geol. Survey Geophysics Paper 5135, scale 1:63,360, 1969.

03200 **Canada Geological Survey.** Aeromagnetic series, Lac Victor, Quebec: Canada Geol. Survey Geophysics Paper 5136, scale 1:63,360, 1969.

03201 **Canada Geological Survey.** Aeromagnetic series, Lac d'Autcuil, Quebec: Canada Geol. Survey Geophysics Paper 5137, scale 1:63,360, 1969.

03202 **Canada Geological Survey.** Aeromagnetic series, Lac Cauchy, Quebec: Canada Geol. Survey Geophysics Paper 5138, scale 1:63,360, 1969.

03203 **Canada Geological Survey.** Aeromagnetic series, Lac Wabouchagamou, Quebec: Canada Geol. Survey Geophysics Paper 5139, scale 1:63,360, 1969.

03204 **Canada Geological Survey.** Aeromagnetic series, Lac Triquet, Quebec: Canada Geol. Survey Geophysics Paper 5140, scale 1:63,360, 1969.

03205 **Canada Geological Survey.** Aeromagnetic series, Tête-à-la-Baleine, Quebec: Canada Geol. Survey Geophysics Paper 5141, scale 1:63,360, 1969.

03206 **Canada Geological Survey.** Aeromagnetic series, La Tabatière, Quebec: Canada Geol. Survey Geophysics Paper 5142, scale 1:63,360, 1969.

03207 **Canada Geological Survey.** Aeromagnetic series, Mutton Bay, Quebec: Canada Geol. Survey Geophysics Paper 5143, scale 1:63,360, 1969.

03208 **Canada Geological Survey.** Aeromagnetic series, Lac Nesle, Quebec: Canada Geol. Survey Geophysics Paper 5144, scale 1:63,360, 1969.

03209 **Canada Geological Survey.** Aeromagnetic series, Lac de Ré, Quebec: Canada Geol. Survey Geophysics Paper 5145, scale 1:63,360, 1969.

03210 **Canada Geological Survey.** Aeromagnetic series, Lac Goyelle, Quebec: Canada Geol. Survey Geophysics Paper 5146, scale 1:63,360, 1969.

03211 **Canada Geological Survey.** Aeromagnetic series, Lac Durocher, Quebec: Canada Geol. Survey Geophysics Paper 5147, scale 1:63,360, 1969.

03212 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 K/13, Quebec: Canada Geol. Survey Geophysics Paper 5148, scale 1:63,360, 1969.

03213 **Canada Geological Survey.** Aeromagnetic series, Lac Gaudreault, Quebec: Canada Geol. Survey Geophysics Paper 5149, scale 1:63,360, 1969.

03214 **Canada Geological Survey.** Aeromagnetic series, Lac Davy, Quebec: Canada Geol. Survey Geophysics Paper 5150, scale 1:63,360, 1969.

03215 **Canada Geological Survey.** Aeromagnetic series, Lac Sanson, Quebec: Canada Geol. Survey Geophysics Paper 5151, scale 1:63,360, 1969.

03216 **Canada Geological Survey.** Aeromagnetic series, Lac Jérôme, Quebec: Canada Geol. Survey Geophysics Paper 5152, scale 1:63,360, 1969.

03217 **Canada Geological Survey.** Aeromagnetic series, Lac Charpeney, Quebec: Canada Geol. Survey Geophysics Paper 5153, scale 1:63,360, 1969.

03218 **Canada Geological Survey.** Aeromagnetic series, Rivière de l'Abbé-Huard, Quebec: Canada Geol. Survey Geophysics Paper 5154, scale 1:63,360, 1969.

03219 **Canada Geological Survey.** Aeromagnetic series, Lac Ruffin, Quebec: Canada Geol. Survey Geophysics Paper 5155, scale 1:63,360, 1969.

03220 **Canada Geological Survey.** Aeromagnetic series, Lac Arthur, Quebec: Canada Geol. Survey Geophysics Paper 5156, scale 1:63,360, 1969.

03221 **Canada Geological Survey.** Aeromagnetic series, Lac Cormier, Quebec: Canada Geol. Survey Geophysics Paper 5157, scale 1:63,360, 1969.

03222 **Canada Geological Survey.** Aeromagnetic series, Lac Bohier, Quebec: Canada Geol. Survey Geophysics Paper 5158, scale 1:63,360, 1969.

03223 **Canada Geological Survey.** Aeromagnetic series, Lac Montcevelles, Quebec: Canada Geol. Survey Geophysics Paper 5159, scale 1:63,360, 1969.

03224 **Canada Geological Survey.** Aeromagnetic series, Lac du Gas, Quebec: Canada Geol. Survey Geophysics Paper 5160, scale 1:63,360, 1969.

03225 **Canada Geological Survey.** Aeromagnetic series, Lac Bernadette, Quebec: Canada Geol. Survey Geophysics Paper 5161, scale 1:63,360, 1969.

03226 **Canada Geological Survey.** Aeromagnetic series, Lac Robertson, Quebec: Canada Geol. Survey Geophysics Paper 5162, scale 1:63,360, 1969.

03227 **Canada Geological Survey.** Aeromagnetic series, Saint-Augustin-Saguenay, Quebec: Canada Geol. Survey Geophysics Paper 5163, scale 1:63,360, 1969.

03228 **Canada Geological Survey.** Aeromagnetic series, Île Bayfield, Quebec: Canada Geol. Survey Geophysics Paper 5164, scale 1:63,360, 1969.

03229 **Canada Geological Survey.** Aeromagnetic series, Blanc-Sablon, Quebec: Canada Geol. Survey Geophysics Paper 5165, scale 1:63,360, 1969.

03230 **Canada Geological Survey.** Aeromagnetic series, Old Fort Bay, Quebec: Canada Geol. Survey Geophysics Paper 5166, scale 1:63,360, 1969.

03231 **Canada Geological Survey.** Aeromagnetic series, Baie Shekatika, Quebec: Canada Geol. Survey Geophysics Paper 5167, scale 1:63,360, 1969.

03232 **Canada Geological Survey.** Aeromagnetic series, Lac Noyrot, Quebec: Canada Geol. Survey Geophysics Paper 5168, scale 1:63,360, 1969.

03233 **Canada Geological Survey.** Aeromagnetic series, Lac Ferru, Quebec: Canada Geol. Survey Geophysics Paper 5169, scale 1:63,360, 1969.

03234 **Canada Geological Survey.** Aeromagnetic series, Lac Verton, Quebec: Canada Geol. Survey Geophysics Paper 5170, scale 1:63,360, 1969.

03235 **Canada Geological Survey.** Aeromagnetic series, Lac Briconnet, Quebec: Canada Geol. Survey Geophysics Paper 5171, scale 1:63,360, 1969.

03236 **Canada Geological Survey.** Aeromagnetic series, Lac Lorens, Quebec: Canada Geol. Survey Geophysics Paper 5172, scale 1:63,360, 1969.

03237 **Canada Geological Survey.** Aeromagnetic series, Lac le Doré, Quebec: Canada Geol. Survey Geophysics Paper 5173, scale 1:63,360, 1969.

03238 **Canada Geological Survey.** Aeromagnetic series, Lac Briend, Quebec: Canada Geol. Survey Geophysics Paper 5174, scale 1:63,360, 1969.

03239 **Canada Geological Survey.** Aeromagnetic series, Lac Barrin, Quebec: Canada Geol. Survey Geophysics Paper 5175, scale 1:63,360, 1969.

03240 **Canada Geological Survey.** Aeromagnetic series, Lac Saumur, Quebec: Canada Geol. Survey Geophysics Paper 5176, scale 1:63,360, 1969.

03241 **Canada Geological Survey.** Aeromagnetic series, Lac Désaulniers, Quebec: Canada Geol. Survey Geophysics Paper 5177, scale 1:63,360, 1969.

03242 **Canada Geological Survey.** Aeromagnetic series, Lac Coupeaux, Quebec: Canada Geol. Survey Geophysics Paper 5178, scale 1:63,360, 1969.

03243 **Canada Geological Survey.** Aeromagnetic series, Rivière aux Touladis, Quebec: Canada Geol. Survey Geophysics Paper 5179, scale 1:63,360, 1969.

03244 **Canada Geological Survey.** Aeromagnetic series, Lac Garneau, Quebec: Canada Geol. Survey Geophysics Paper 5180, scale 1:63,360, 1969.

03245 **Canada Geological Survey.** Aeromagnetic series, Lac Ripault, Quebec: Canada Geol. Survey Geophysics Paper 5181, scale 1:63,360, 1969.

03246 **Canada Geological Survey.** Aeromagnetic series, Lac du Caribou, Quebec: Canada Geol. Survey Geophysics Paper 5182, scale 1:63,360, 1969.

03247 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 N/12, Quebec: Canada Geol. Survey Geophysics Paper 5183, scale 1:63,360, 1969.

03248 **Canada Geological Survey.** Aeromagnetic series, Lac du Nord, Quebec: Canada Geol. Survey Geophysics Paper 5184, scale 1:63,360, 1969.

03249 **Canada Geological Survey.** Aeromagnetic series, Lac le Tort, Quebec: Canada Geol. Survey Geophysics Paper 5185, scale 1:63,360, 1969.

03250 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 N/9, Quebec: Canada Geol. Survey Geophysics Paper 5186, scale 1:63,360, 1969.

03251 **Canada Geological Survey.** Aeromagnetic series, Lac Vitré, Quebec: Canada Geol. Survey Geophysics Paper 5187, scale 1:63,360, 1969.

03252 **Canada Geological Survey.** Aeromagnetic series, Rivière à Saumon, Quebec: Canada Geol. Survey Geophysics Paper 5188, scale 1:63,360, 1969.

03253 **Canada Geological Survey.** Aeromagnetic series, Lac Île au Castor, Quebec: Canada Geol. Survey Geophysics Paper 5189, scale 1:63,360, 1969.

03254 **Canada Geological Survey.** Aeromagnetic series, Lac Tooker, Quebec: Canada Geol. Survey Geophysics Paper 5190, scale 1:63,360, 1969.

03255 **Canada Geological Survey.** Aeromagnetic series, Lac Delage, Quebec: Canada Geol. Survey Geophysics Paper 5191, scale 1:63,360, 1969.

03256 **Canada Geological Survey.** Aeromagnetic series, Collines de Bradore, Quebec: Canada Geol. Survey Geophysics Paper 5192, scale 1:63,360, 1969.

03257 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 P/14, Quebec: Canada Geol. Survey Geophysics Paper 5193, scale 1:63,360, 1969.

03258 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 P/13, Quebec: Canada Geol. Survey Geophysics Paper 5194, scale 1:63,360, 1969.

03259 **Canada Geological Survey.** Aeromagnetic series, Lac Gallet, Quebec: Canada Geol. Survey Geophysics Paper 5195, scale 1:63,360, 1969.

03260 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 O/15, Quebec: Canada Geol. Survey Geophysics Paper 5196, scale 1:63,360, 1969.

03261 **Canada Geological Survey.** Aeromagnetic series, Lac Aticonipi, Quebec: Canada Geol. Survey Geophysics Paper 5197, scale 1:63,360, 1969.

03262 **Canada Geological Survey.** Aeromagnetic series, Lac Chenil, Quebec: Canada Geol. Survey Geophysics Paper 5198, scale 1:63,360, 1969.

03263 **Canada Geological Survey.** Aeromagnetic series, Lac le Breton, Quebec: Canada Geol. Survey Geophysics Paper 5199, scale 1:63,360, 1969.

03264 **Canada Geological Survey.** Aeromagnetic series, Lac Golet, Quebec: Canada Geol. Survey Geophysics Paper 5200, scale 1:63,360, 1969.

03265 **Canada Geological Survey.** Aeromagnetic series, Lac Bastille, Quebec: Canada Geol. Survey Geophysics Paper 5201, scale 1:63,360, 1969.

03266 **Canada Geological Survey.** Aeromagnetic series, Sheet 12 N/13, Quebec: Canada Geol. Survey Geophysics Paper 5202, scale 1:63,360, 1969.

03267 **Canada Geological Survey.** Aeromagnetic series, Lac Bégon, Quebec: Canada Geol. Survey Geophysics Paper 5203, scale 1:63,360, 1969.

03268 **Canada Geological Survey.** Aeromagnetic series, Lac de Morhiban, Quebec: Canada Geol. Survey Geophysics Paper 5204, scale 1:63,360, 1969.

03269 **Canada Geological Survey.** Aeromagnetic series, Lac Goullay, Quebec: Canada Geol. Survey Geophysics Paper 5205, scale 1:63,360, 1969.

03270 **Canada Geological Survey.** Aeromagnetic series, Lac Norman, Quebec: Canada Geol. Survey Geophysics Paper 5206, scale 1:63,360, 1969.

03380 **Card, K. D.** Sudbury District, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 2: Ontario Dept. Mines Misc. Paper 24, p. 25-38, 1969.

Mining and exploration activity was at a high level during 1967, but fewer claims were filed in 1968. Mineral products valued at 654,492,390 dollars were produced in the district in 1968, with nickel and copper leading. Most of the 1968 exploration was for uranium. New information and recommendations for future exploration are given; Ontario Dept. Mines maps issued during 1968 and other new maps and literature are listed.—ESL

Carey, A. G. *See* Griggs, G. B. 03304

03116 **Carlson, Marvin P.; Berry, William B. N.** Late Middle Ordovician graptolites from the subsurface of eastern Nebraska: Jour. Paleontology, v. 43, no. 3, p. 712-715, illus., 1969.

Graptolite rhabdosomes identified as *Climacograptus typicalis* var. *crassimarginalis* Ruedemann and Decker were obtained from a dolomite core in eastern Nebraska. The occurrence of this graptolite suggests a late Middle Ordovician (late Wilderness-Trenton) age for the rocks bearing it. This and other occurrences of the species support an interpreted widespread distribution of carbonates of this age in the continental interior. Flanges projecting from the genicular angle of the thecae have aided in flotation in warm shallow seas and permitted wide distribution in carbonate environments.—*from* Authors' abstract

03594 **Carrigan, P. H., Jr.** Inventory of radionuclides in bottom sediment of the Clinch River, eastern Tennessee: U.S. Geol. Survey Prof. Paper 433-I, p. I1-I18, illus., tables, 1969.

An inventory was made of radionuclides associated with bottom sediment in the lower Clinch River, a reach of 21 mi. Source of the radionuclides was release of low-level-radioactive waste waters from Oak Ridge National Laboratory. Results indicate the following quantities of radioactivity (in curies) in July 1962: cesium-137, 150; cobalt-60, 18; ruthenium-106, 16; rare earths, at least 10; strontium-90, 2.9. About 95 percent of identified radioactivity was found downstream from mile 15; maximum concentration occurred near the mouth of Whiteoak Creek. A high proportion of cesium-137 (21 percent), rare earths (about 25 percent), and cobalt-60 (9

percent) released to the river are retained in bottom sediment of the study reach. Retention of ruthenium-106 and strontium-90 is less than one percent each.—*from* Author's abstract

Carver, Robert E. *See* Rucker, James B. 03113

Case, James E. *See* Zietz, Isidore. 03483

03395 **Chagnon, Jean-Y.** Study of erosion phenomena and unconsolidated deposits in Baie-Saint-Paul—Saint-Urbain area, Charlevoix County [also French edition]: Quebec Dept. Nat. Resources Spec. Paper 3, 29 p., illus., tables, geol. map, 1969.

Most of mapping work done in this area in 1965 was concentrated in and along the valley of Gouffre River, approximately 65 miles from Quebec. The principal object was to map unconsolidated deposits to facilitate subsequent studies on erosion phenomena and remedial works along the course of the river, which has caused considerable damage to farmlands. In detailed examination of the banks of the river and streams, of sand and gravel pits, ditches, aqueduct trenches, and roadcuts, two Pleistocene deposits were distinguished: (a) glacial ablation moraine, till, sand and gravel; (b) Champlain Sea deposits of brown or blue-gray clay, commonly fossiliferous, and beach, deltaic or fluvioglacial sand and gravel. Holocene deposits are displaced sediment in the alluvial plain; landslides disturb the terraces.—GDC

03590 **Chamberlain, John A., Jr.** Technique for scale modelling of cephalopod shells: Palaeontology, v. 12, pt. 1, p. 48-55, illus., 1969.

Previous work by Raup on the mathematical description of coiled shells provides a foundation for the construction of three-dimensional scale models of cephalopod shells. A computer program, based on the method of Raup, has been developed which contours planispiral surfaces of the cephalopod type. The computer output is then used to construct plastic models of these surfaces. The morphological range covered by this program includes the entire suite of planispiral cephalopod forms. Provision is made for the simulation of both actual fossil species and hypothetical morphologies. In addition, mathematical simulation of accretionary growth allows the modelling of different stages of ontogenetic series.—Author's abstract

03020 **Chan, Paul Chi-Keung.** A study of dynamic load-deformation and damping properties of sands concerned with a pile-soil system [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4156B, 1969.

03027 **Chapman, Diana Ferguson.** Petrology, structure and metamorphism of a concordant granodiorite gneiss in the Grenville Province of southeastern Ontario [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4224B-4225B, 1969.

03510 **Chapple, William M.** Fold shape and rheology—The folding of an isolated viscous-plastic layer: Tectonophysics, v. 7, no. 2, p. 97-116, illus., 1969.

A numerical study of finite-amplitude folding of a thin, free viscous-plastic layer reveals two types of instability: Physical instability, associated with plastic properties of a layer, gives rise to very large shortening velocities if load is constant. Geometric instability, associated with the finite-amplitude shape of a layer and therefore present even for a viscous layer, makes stresses at the crest decrease when the layer is folded under constant shortening strain-rate. Thus, history of a fold is strongly dependent on variation of external load with time; a layer will deform viscously in early stages of folding then yield plastically, and finally deform viscously again. Resistance of a volume of layered rocks to deformation will vary markedly during deformation. Fold shape depends on the fraction of folding history during which plastic yielding occurs.—*from* Author's abstract

02977 **Charlton, David S.** An improved technique for heavy liquid separation of conodonts: Jour. Paleontology, v. 43, no. 2, p. 590-592, illus., tables, 1969.

An automatic stirring technique is described for heavy liquid (tetrabromoethane) separation of conodonts from lighter sediment. A jet of compressed air mixes the material floating in the liquid and turns the stirring device, which consists of three pairs of upward projecting plastic paddles cut to the shape of the funnel and fitted together at the bottom with a metal weight. Recovery experiments using the same group of 20 large and 20 small conodonts showed that after 30 minutes automatic stirring gave results comparable to those of manual stirring for 2 hours at 5-minute intervals. In both cases, small conodonts were harder to recover than large conodonts, but somewhat less so with automatic stirring.—VMJ

Cheetham, Alan H. *See* Boardman, Richard S. 03001

03165 **Chen, Kuang-Chian.** Stochastic model study of diffusion of solid particles [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3753B, 1969.

03096 **Chenoweth, Philip A.** Reply [to discussion by Howard A. Meyerhoff of "Early Paleozoic (Arbuckle) overlap, southern Mid-Continent, United States," 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1520-1521, 1969.

In reply to Meyerhoff's discussion (ibid., p. 1519-1520), Chenoweth points out that no definition of peneplane implies absence of relief.—SEF

03132 **Chinnery, Michael A.** Theoretical fault models [with French abs.], *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 211-223, illus., tables, 1969.

A number of theoretical models which may be applied to the study of fault mechanics are reviewed, with particular emphasis on the boundary conditions assumed for the surfaces of the crack. The displacements and stresses which arise on the boundaries of the crack under the action of an applied shear stress are derived for each model. Particular consideration is given to the model which includes a frictional stress that increases linearly with depth. As an application of these models, the stress drops associated with some real faults are calculated in several ways using a variety of fault parameters. The calculated stress drops for vertical strike slip faults show a very small spread, and generally lie within the range of 30 to 60 bars. Similar calculations for dip slip faults have a much larger spread, probably because of inadequate field data. A discussion of the usefulness of more complex fault models is included.—Author's abstract

03446 **Chromy, Stanislav.** Photoelectric apparatus for refractive index determination by the immersion method: Am. Mineralogist, v. 54, nos. 3-4, p. 549-553, illus., 1969.

To reduce the subjective error in refractive index determination by the immersion method a photomultiplier together with phase contrast was used. The special adaptation of the photomultiplier diaphragm rendered it possible to determine the temperature of matched refractive indices of the liquid and the measured material based on the photomultiplier output.—Author's abstract

03407 **Churkin, Michael, Jr.** Paleozoic tectonic history of Alaska and the origin of the Arctic basin [abs.]: Houston Geol. Soc. Bull., v. 11, no. 8, p. 35, 1969.

03401 **Cifelli, Richard.** Radiation of Cenozoic planktonic Foraminifera: Systematic Zoology, v. 18, no. 2, p. 154-168, illus., 1969.

The general aspects of planktonic foraminiferal radiation during the Cenozoic are shown by the distributional patterns of several morphotypic groups. There were two major radiations, one occurring during the Paleogene, the other during the Neogene. The radiations followed severe reductions in diversity which occurred at the close of the Cretaceous and again during the mid-Tertiary. Distributional patterns are iterative, and the Neogene radiation is essentially a repetition of what occurred during the Paleogene. According to the present interpretation, the iterative patterns reflect major changes in the dynamic structure of surface waters. By analogy with the dis-

tribution of the modern fauna, it is suggested that thermal barriers were degraded during times of reduction and the oceans were uniformly cool. During the radiations thermal gradients were restored and the structure of the surface waters was essentially as it is today.—Author's abstract

Clabaugh, Stephen E. *See* Dasch, E. Julius. 03506

03125 **Clark, David L.; Robison, Richard A.** Oldest conodonts in North America: Jour. Paleontology, v. 43, no. 4, p. 1044-1046, illus., 1969.

Conodonts are abundant in the Emigrant Springs Limestone of eastern Nevada, in association with Middle Cambrian trilobites of the *Lejopyge calva* Subzone. Seven species of conodonts referred to *Distacodus*, *Furnishina*, *Hertzina*, *Oneotodus* and *Westergaardodina* are listed from a locality in the Schell Creek Range, and four species are figured. Trilobites, mollusks, and inarticulate brachiopods, are also listed. The conodonts include most of the same few species reported from the Middle Cambrian of Scandinavia. The oldest conodonts previously reported in North America are Late Cambrian in age.—JWH

Clarke, R. T. *See* Moiola, R. J. 03289

03421 **Cleary, John.** The S velocity at the core-mantle boundary, from observations of diffracted S: Seismol. Soc. America Bull., v. 59, no. 3, p. 1399-1405, illus., tables, 1969.

A regression line has been fitted to times of diffracted S observed at Canberra from 11 earthquakes. When corrections are made to the observed times to compensate for probable mislocations of the earthquakes, a value of 8.9 sec per deg is obtained for the traveltime gradient, with a 95 percent confidence interval estimate of 0.2 sec per deg. Assuming a core radius of 3473 km, this corresponds to an S velocity at the core-mantle boundary of 6.8 kmps. This is 0.5 kmps lower than the value given by Jeffreys (1939). The analysis also provides an estimate of the S time at 100° distance which is about 12 sec greater than that given in the Jeffreys-Bullen tables. The results suggest that current models of the lowest part of the mantle are significantly in error. Revision of the model in this region should enable a more satisfactory reconciliation with free oscillation data.—Author's abstract

03463 **Cloke, Paul L.; Poindexter, Edward H.** Memorial of Reynolds McConnell Denning—September 3, 1916-November 1, 1967: Am. Mineralogist, v. 54, nos. 3-4, p. 609-614, portrait, 1969.

03012 **Cocke, J. M.; Cocke, N. C.** Redescription of a Pennsylvanian geyerophyllid coral species from Iowa: Jour. Paleontology, v. 43, no. 4, p. 941-946, illus., table, 1969.

The Pennsylvanian (Missourian,) geyerophyllid rugose coral, *Axophyllum rudis* White and St. John, 1867, is redescribed and placed in *Geyerophyllum* Heritsch, 1936. Like other geyerophyllids, *G. rude* possesses a cardinal-columella, lonsdaleoid dissepiments, longitudinal ribbing, and narrow tabularium. It differs from them in shape of lonsdaleoid dissepiments and lack of minor septa in ephebic stages.—*from* Authors' abstract

Cocke, N. C. *See* Cocke, J. M. 03012

03441 **Colbeck, S. C.; Evans, Roger J.** Experimental studies related to the mechanics of glacier flow: Trend Eng., v. 21, no. 2, p. 8-14, illus., 1969.

This paper describes field experiments that have been carried out at Blue Glacier on Mt. Olympus with the purpose of improving understanding of the nature of glacier flow. We first discuss tests carried out under conditions similar to those actually occurring in the glacier; then we describe our attempt to learn more of the mechanism of crevasse formation through an experimental program in which we determined strain rates in crevasse fields.—Authors' abstract

03137 **Colbert, Edwin H.; Russell, Dale A.** The small Cretaceous dinosaur *Dromaesaurus*: Am. Mus. Novitates, no. 2380, 49 p., illus., tables, 1969.

It is evident that the *Dromaesaurus* specimen, collected at Sand Creek on the south bank of the Red Deer River, Alberta, is neither coelurosaur nor carnosaur, but rather that it belongs to a new group of theropod dinosaurs. This group of dinosaurs, here accorded the rank of an infraorder, and designated as the deinonychosaurs, is specialized along lines that are in part intermediate between and in part quite distinct from the other two theropod infraorders. The deinonychosaurs are characterized by numerous specializations in the skull and forelimbs and hind limbs for predaceous habits. Theropods of this type were rather abundant and widespread during the Cretaceous.—KAF

03653 **Cole, J. Glenn.** Cherokee Group, east flank of the Nemaha Ridge, north-central Oklahoma—Pt. 1: Shale Shaker, v. 19, no. 8, p. 134-146, illus., 1969; Pt. 2, ibid., no. 9, p. 150-160, illus., 1969.

The Nemaha Ridge in this area is a broad feature, with the eastern flank forming the western flank of Pryor basin. Seventy-seven sample logs were used in the study. The terms genetic sequence and genetic increment of strata are defined. Potter's study of the geometry of sand bodies is reviewed, including the six major environments for sand accumulation. Discussion of the stratigraphy includes delineation of marker-defined units, possible unconformities in the Cherokee Group, pre-Desmoinesian rocks, and Cherokee genetic sequence. Isopach maps portray the pre-Desmoinesian subcrop, Gilcrease, Booch, Bartlesville, Red Fork, Skinner, and Prue-Calvin genetic increment of strata, and Cherokee genetic sequence.—ESL

03156 **Collins, James Finnbarr.** The Eh-pH environment and iron-manganese equilibria in soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3575B, 1969.

03638 **Colton, Roger B.** Surficial geologic map of the New Preston quadrangle, Litchfield County, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-782, scale 1:24,000, 1969.

03365 **Colwell, Robert N.** Potential uses of earth-orbital imagery for the inventory of earth resources, *in* Earth resource surveys from spacecraft, V. 1 (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. x-xxxi, illus. [1969,].

There is an increasing demand for inventory data regarding natural resources of the Earth as a step toward intelligent management of resources. There must be a clear understanding of kinds of data needed; the imagery and equipment used must be of suitable quality; personnel extracting the data must be properly selected and trained; and methods and techniques used must permit the image analyst to extract the data efficiently and accurately. Some representative examples are given.—ESL

03303 **Correns, Carl W.; Zemann, Josef; Koritnig, Sigmund.** Introduction to mineralogy—Crystallography and petrology: New York, Springer-Verlag, 484 p., illus., tables, 1969.

This text was revised due to the rapid extension of knowledge since its first edition in 1949. Important additions were made in sections on volatile constituents, metamorphic facies and isotope geochemistry. The text is divided into ten sections: crystal mathematics, crystal chemistry, crystal physics, crystal growth and dissolution, some physical-chemical fundamentals, formation of magmatic (igneous) rocks, weathering and soil mineral formation, sedimentary rocks, metamorphic petrogenesis, and geochemical considerations. The appendix includes a list of crystallographic and petrologic tables, and a summary of the common minerals and their properties. This English edition was translated by William D. Johns.—JNR

02961 **Cowen, Richard.** Stegidial structures in spiriferide brachiopods: Jour. Paleontology, v. 43, no. 2, p. 538-539, illus., 1969.

Structures identical or homologous with the stegidium, a delthyrial cover, are widespread among superfamilies Spiriferacea and Spiriferinacea of suborder Spiriferidina. Stegidial structures are present in forms ranging from Middle Devonian through Jurassic and are useful in classification. The stegidium is entirely different in

structure from the deltidium and chilidium of other spiriferides and other brachiopods, and is thought to have evolved only once.—REG

02966 **Craig, B. G.** Late-glacial and postglacial history of the Hudson Bay region, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 63-77, illus., tables, 1969.

Retreat of the main Wisconsin ice sheet began in northern Canada some 13,000 or more years ago, although ice probably remained in the Hudson Bay area until about 7,000 years ago. The stratigraphic succession of deposits, variations in the pattern of ice-flow features and their relation to the maximum elevation and extent of the marine invasion and radiocarbon age of organic remains allows a rough chronology of the sequence of events to be established.—*from* Author's abstract

03349 **Craig, Gordon Y.; Rabbitt, Mary C.** Sir Archibald Geikie—Letters from American geologists: Geotimes, v. 14, no. 5, p. 21, 1969.

03435 **Crickmay, C. H.** The art of looking at broad valleys: Calgary, Alberta, Evelyn de Mille Books, 21 p., 1969.

Broad valleys may range in depth from a few feet to several thousand and in width from a mile or less to fifty miles or more. Broadening has been attributed to lateral stream erosion and down-wasting of valley walls. Penck's idea of endless retreat of escarpments is considered, but in many scarps, retreat has become extinct. Discrepancies in erosional achievement as seen in nature are described. The author presents a new viewpoint including the principle of unequal activity. Processes that are supposed to produce near-level flats are listed, and some new ones added. In the broad valleys of the western plains the stream cuts not only the scarp but the bedrock floor. Study of valleys of different sizes, some with terraces, leads to the conclusion that all of it is the work of running water at grade. The Book Cliffs might be considered as the north wall of the valley of the upper Colorado, which would be a super-broad valley.—ESL

Crittenden, M. D., Jr. *See* Zietz, Isidore. 03483

03079 **Cronoble, James M.** Geothermal gradients and their application to petroleum geology: Mtn. Geologist, v. 6, no. 1, p. 27-39, illus., table, 1969.

The time necessary to re-establish the thermal equilibrium disturbed by drilling processes depends primarily upon the drilling method, drilling rate and time, hole diameter, mud circulation, and rock nature. In general, the slower the rate, the longer the drilling time, the larger the diameter, the longer the mud circulation the longer the re-establishment time. Increasing rock porosity decreases conductivity, and grain size and shape influence porosity. Fluid saturation increases conductivity, and increasing temperature results in decreasing conductivity, while increasing pressure increases conductivity. Convection currents, if they exist, have little effect on the gradient, but gradients may be appreciably altered by subsurface water flow, and climatic variations. Weathering, erosion, and uplift, all tend to increase temperature gradient. Petroleum industry applications include correlation, electric log interpretation, and other temperature associated features.—*from* Author's abstract

03399 **Cuffey, Roger J.** Bryozoa versus Ectoprocta—The necessity for precision: Systematic Zoology, v. 18, no. 2, p. 250-251, 1969.

Considering the fundamental purpose of language—including taxonomic language—the name Bryozoa should be used *only* to denote the concept "Entoprocta plus Ectroprocta", and *not* be redefined to denote "Ectoprocta only" as Mayr (1968) advocates. Such a change would result in confusing ambiguity whenever the high-rank name Bryozoa would be used. Ample historical precedent supports the retention of Bryozoa, Entoprocta, and Ectoprocta as three separate and distinct taxonomic concepts. For example, the term Molluscoidea, used for some time to denote "Bryozoa plus Brachiopoda", was *not* redefined when the two subordinate groups were raised to phyllum rank. For the concept "Ectoprocta only" the name Ectoprocta should be used.—GDC

02970 **Cumming, L. M.** Rivers of the Hudson Bay Lowlands, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 144-168, illus., 1969.

The distribution of Precambrian and Paleozoic formations and the preglacial history of the Hudson Bay Lowlands are geological influences which helped to shape the character of individual rivers and streams of the Lowlands. These geological influences upon various individual rivers of the Hudson Bay Lowlands are described and summarized. The rivers of the Hudson Bay Lowlands are an important and unique natural resource. Aspects of the transportation and hydroelectric potential of some of the rivers are summarized.—Author's abstract

03652 **Cutolo-Lozano, Francisco.** Subsurface geology of the Seminole area, Seminole, Pottawatomie, and Okfuskee Counties, Oklahoma: Shale Shaker, v. 19, no. 7, p. 118-130, illus., 1969.

The paper presents three structure contour, one isopach map, and two electric-log cross sections of oil fields in this area; 14 fields are described. The study indicates: unconformities are at the tops of the Atokan and Morrowan Series, Mississippian sediments, and Hunton Limestone; top of the Fernvale-Viola Limestone reflects structures in Simpson and Arbuckle strata; normal faults trend northeast-southwest and east-west; Calvin sand is the youngest oil-producing horizon, the Second Wilcox the oldest; most productive horizons were Cromwell, Earlsboro, Misener, Senora, and Wilcox sands, and Hunton lime, with most producing wells in the Cromwell; oil is in both stratigraphic and structural traps; many local structures originated during post-Hunton, pre-Mississippian time and were affected again by the Wichita orogeny; and undiscovered horizons are undoubtedly present.—ESL

03130 **Daly, Eleanor.** A new procolophonoid reptile from the Lower Permian of Oklahoma: Jour. Paleontology, v. 43, no. 3, p. 676-687, illus., 1969.

A new genus and species, *Acleistorhinus pteroticus*, and a new family, Acleistorhinidae, are based on a skull from the Lower Permian of southern Oklahoma, associated with an Arroyo fauna, including *Dimetrodon loomisi* Romer. *Acleistorhinus* is associated with the Procolophonoidea because of: paroccipital processes extending dorsally; deep triangular skull; shortened jaws with articulations well forward of the occipital condyle; shallow otic notch; apparently a single pair of large temporal bones; small squamosals; large postorbitals; fused basicranial articulations. Distinctive features are: lower temporal fenestrae, stapes of complex form, and an unossified gap in the end of the snout. The procolophonians, considered cotylosaurs, probably originated during the Pennsylvanian.—*from* Author's abstract

03425 **Danes, Z. F.** Convection in the interiors of planets: Icarus, v. 10, no. 1, p. 53-56, 1969.

Ashworth's analysis [by the theory of nonthermal convection, 1968] of the above problem is expanded to include variable viscosity, thermal expansion, thermal diffusivity, distribution of heat sources, as well as compressibility due to self-gravitation. By permitting the free upper surface of the planet to be perturbed by the hydrodynamic stresses, the system becomes nonhomogeneous, no longer requires distinct values of the geometric parameters, and may give actual values of the velocity field, rather than just ratios of magnitudes of various components.—Author's abstract

03350 **Darrah, William C.** John Wesley Powell, his western explorations: Geotimes, v. 14, no. 5, p. 13-15, illus., 1969.

03506 **Dasch, E. Julius; Armstrong, Richard L.; Clabaugh, Stephen E.** Age of Rim Rock dike swarm, Trans-Pecos, Texas: Geol. Soc. America Bull., v. 80, no. 9, p. 1819-1823, illus., table, 1969.

Potassium-argon dates for basaltic rocks from the Rim Rock dike swarm of Trans-Pecos Texas range from 18 to 23 m.y. Because these dikes are closely associated with major normal faults, they indicate the age of Basin-Range faulting in the region.

Two sets of dikes are distinguishable not only by strike and petrology, but also by age. The older, basaltic and trachybasaltic set and the younger, more alkalic set have average ages of 22.3 and 19.2 m.y. respectively. Extensive deuteric alteration has not modified significantly the K-Ar dates of the rocks.—Authors' abstract

Davies, John. *See* Gedney, Larry. 03422

03369 **Davis, Charles M.** Minor landforms—Mega-landtypes of the New Mexico-Texas-Mexico plain, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. E38-E41, illus. [1969,].

This photo covers the Stocton Plateau between the Pecos River and the Rio Grande. The angle is oblique causing some distortion, and the color is deceptive. Good black and white photography or photomosaics might be better. Larger surface features are the Davis Mts. on the east, the Sierra Diablo Plateau on the west, and the Rio Grande and Pecos Rivers. Two overlays show natural and cultural features.—ESL

03616 **Dawson, Gary J.** Credo, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 46-51, illus., 1969.

03275 **Debnam, A. H.** Geochemical prospecting for petroleum and natural gas in Canada [with French abs.]: Canada Geol. Survey Bull. 177, 26 p., illus., 1969.

The Innisfail and Pincher Creek fields in Alberta and Gobles and Colchester fields in southwestern Ontario were chosen for study, using soil sampling technique. Factors that may cause erroneous results include variations in soil type and uneven topography; it is recommended that surveys be restricted to areas in which adverse factors contribute minimum errors. Presence of deep glacial deposits at the surface and of large amounts of hydrocarbons distributed through sediments above oil and gas pools does not seem to have an unduly adverse effect on results. Geochemical anomalies appear to be associated with all fields studied with anomaly intensity roughly proportional to productivity. Each of the 'halo' and 'solid' types of anomalies can be recognized. Geochemical methods can be a valuable addition to usual geological and geophysical exploration methods if used under favorable circumstances.—*from* Author's abstract

03581 **Dehlinger, Peter.** Evidence regarding the development of Juan de Fuca and Gorda Ridges in the northeast Pacific Ocean: New York Acad. Sci. Trans., ser. 2, v. 31, no. 4, p. 379-403, illus., 1969.

These two oceanic ridges lie off the coast of Washington, Oregon, and northern California. Mantle depths near both ridges and adjoining basins are quite shallow and the upper mantle has a below normal velocity, fault motions are consistent with tension rather than compression, and heat flow is high along both ridges and to the east. The area is in near isostatic equilibrium as shown by gravity anomalies. Geomagnetic anomalies and correlated sediment ages are evidence of sea-floor spreading. An extensive thickness of low-density mantle material must exist beneath both ridges. The author proposes an alternative process to that of convection currents involving the slippage of an outer shell on the main Earth along the low velocity channel. It incorporates the concepts of plate tectonics of Morgan, the diapiric intrusions of Maxwell, and is consistent with the data given here. Possible mechanisms are suggested.—ESL

DeHon, Rene A. *See* Pratt, Walden P. 03640

Delach, M. N. *See* Horn, D. R. 03484

03144 **Delfino, Joseph J.** Fresh water lake systems as media for chemical reactions [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 32, 1969.

03305 **Deuser, W. G.; Hunt, J. M.** Stable isotope ratios of dissolved inorganic carbon in the Atlantic: Deep-Sea Research, v. 16, no. 2, p. 221-225, illus., 1969.

ΔC-13 values of oceanic inorganic carbon from six stations in the North and South Atlantic vary between -1 and 2 percent relative to the PDB standard. A correlation between the concentration of dissolved oxygen and C-13 is observed at all stations below the top 200 m. The correlation is due to the oxidation of organic matter depleted in C-13. The extent of the isotope shift in the dissolved inorganic carbon is a measure of the amount of organic carbon oxidized.—Authors' abstract

03444 **deWaard, Dirk; Romey, William D.** Chemical and petrologic trends in the anorthosite-charnockite series of the Snowy Mountain massif, Adirondack highlands: Am. Mineralogist, v. 54, nos. 3-4, p. 529-538, illus., table, 1969.

Anorthosite in the core of Snowy Mountain massif is closely associated with, and partly transitional into, rocks that form a shell around the anorthosite core. These rocks range from leucocratic norite near the core to charnockite near the margin of the massif. Modal analyses show a gradual increase in K feldspar and quartz from core to margin. Chemical analyses further show a gradual decrease in the normative anorthite percentage and an increase in Fe-Mg ionic proportion. The completely gradual compositional sequence of members of the anorthosite-charnockite series favors an origin by differentiation from one magma, or formation of part of the magma by anatexis, rather than an origin involving two magmatic events.—Authors' abstract

03390 **Dietz, Robert S.** Ocean basins and lunar seas: Oceans, v. 2, no. 1, p. 7-15, illus., 1969.

Both maria and ocean basins are vast depressions in planetary crust; both are floored with a dark deposit presumed to be basalt, and both have smooth expanses as compared with the upland. Three aspects in which they differ are: there is no general interconnection between marias, their depths in the lunar crust differ, they are underlain by heavy masses that are out of balance with the uplands, and there are no shelves on the maria. The maria bear no relationship to our oceans, which have a more complex history. The Earth formed by accretion; later liquid iron settled to make the core, and sialic components rose to form the crust. Water and gases were squeezed out and the oceans formed. Sea-floor spreading and transform faults are discussed.—ESL

03283 **Dillon, Ed L.** Problems inherent in the computer processing of well log data, *in* SPWLA Logging Symposium, 10th Ann., Houston, Tex., 1969, Trans.: Houston, Tex., Soc. Prof. Well Log Analysts, p. U1-U6, table, 1969.

The following problems in the computer processing of well log data are discussed: (1) digitizing in the field versus office; (2) the cost of digitizing methods; (3) efficient analysis of the digital data; and (4) the storage, updating, and manipulation of the data file. Various techniques used in log digitizing, and some of the characteristics of each are tabulated.—KAF

Dilts, Robert L. *See* Tien, Pei-Lin. 03531

03427 **Dionne, Jean-Claude.** Une structure sédimentaire alvéolaire d'origine biologique: Rev. Geographic Montreal, v. 23, no. 2, p. 197-199, illus., 1969.

Primary sedimentary structures of interference ripple marks produced by the thrashing of tadpoles have been observed, some occupied by the tadpoles, on bottoms of shallow or dry ponds in several places in the Lac Saint-Jean area of southern Quebec. The tadpole holes are circular depressions 10-20 mm in diameter and 5-15 mm deep forming an alveolar pattern on the sandy silt bottoms; they are produced generally from mid-June through mid-August and normally disappear at the end of summer but may be preserved by burial. Hitchcock (1858) first described the structures as "tadpole nests"; S. W. Maher (1962) observed structures produced by tadpoles. Kindle (1914) and most later authors attributed the structures primarily to wind action.—VMJ

Downie, Charles. *See* Ford, Trevor D. 03057

02995 **Driscoll, Egbert G.; Newton, Geoffrey B.** A new species of the coral *Syringopora* from the Tensleep Formation (Pennsylvanian) of Montana: Jour. Paleontology, v. 43, no. 2, p. 531-534, illus., 1969.

Syringopora centrocylindrica, n.sp., was found in life position in cemented orthoquartzite approximately 30 feet below the contact between the Pennsylvanian (Desmoinesian) Tensleep and the Permian Phosphoria Formations on the east margin of the Beartooth Mountains near Red Lodge, Mont. Tabulate corals seldom have been reported from the Tensleep and never before from its nearshore sandstone facies.—RCD

03586 **Duke, Michael B.** Surveyor alpha-scattering data—Consistency with lunar origin of eucrites and howardites: Science, v. 165, no. 3892, p. 515-517, illus., tables, 1969.

According to the hypothesis that eucrite and howardite achondrites originated on the Moon, the lunar uplands consist of coarse-grained mafic to ultramafic igneous rocks which crystallized at depth and subsequently were fragmented and repeatedly mixed to form polymict breccias (the howardites), while the maria are younger basaltic rocks of distinctive iron-rich composition (the eucrites). Within the limits of analytical error, the Surveyor 7 analyses are included by the range of compositions of howardites and related meteorites. In that rock assemblage, such plagioclase-rich rocks as the Serra de Mage meteorite are rare and are believed to represent crystal accumulates formed under slow crystallization of ultramafic magma. With refinements of the Surveyor data it may be possible to decide between the eucrite-howardite hypothesis and other suggestions for the composition of lunar surface rocks.—DBV

03561 **Dunham, Robert J.** Early Vadose Silt in Townsend mound (reef), New Mexico, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 139-181, illus., 1969.

Vugs, fractures, interstices, and other voids in the Townsend carbonate mound (reef) are floored with internal sediment composed of well sorted silt. Internal sedimentation predates precipitation of blocky cement, and postdates both precipitation of early drusy cement and early internal erosion. The silt differs from associated marine sediment in its scarcity of clay-size particles, sand-size particles, and recognizable skeletal debris. Age relationships and texture of the silt seem best explained as due to sedimentation inside preexisting crumbly rock in the vadose zone of an island during early emergence. If the explanation is valid, similar internal sediment might be a valuable clue to previously unrecognized subaerial stages in other carbonate mounds.—Author's abstract

03562 **Dunham, Robert J.** Vadose pisolite in the Capitan Reef (Permian), New Mexico and Texas, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 182-191, illus., 1969.

New evidence on the pisoliths of the Permian Capitan reef complex indicates that they are not of lagoonal algal-nodule origin, but are early vadose concretions and probably Permian pisolitic caliche. If the reinterpretation is valid, the pisolite implies that: (1) the climate was dry, (2) the reef complex was subaerially exposed repeatedly during its growth, with attendant opportunities for diagenetic alteration of porosity and for "inorganic binding," and (3) the paleotopographic crest of the complex was not in the so-called organic reef-rock, that is, in the sponge-bearing lime wackestone of the Capitan facies, but instead was in the dolomitized grainstone of the Carlsbad facies.—*from* Author's abstract

Dutro, J. Thomas, Jr. *See* Sando, William J. 03596

03157 **Eaddy, Donald Workman.** Relation between drainage class and certain chemical properties of soil organic matter [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3576B, 1969.

03536 **Easterbrook, Don J.** Principles of geomorphology: New York, McGraw-Hill Book Co., 462 p., illus., 1969.

This book, intended primarily for undergraduate students, stresses fundamentals, and therefore necessitates omission or mere cursory coverage of many other aspects of geomorphology. Selected references to most topics are listed at the end of each of the 29 chapters, which are grouped into eight parts: fundamentals of geomorphology, glaciation, fluvial morphology, valley-side process, ground water, desert and eolian landforms, coastal morphology, and relationships of geologic structure to topography.—MCM

Edgar, N. T. *See* Peterson, M. N. A. 03426

03097 **Edwards, Everett C.** Merwin Guy Edwards (1889-1969): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1524-1525, portrait, 1969.

03534 **Ehrlich, Paul R.; Holm, Richard W.; Raven, Peter H.** (selectors). Papers on evolution: Boston, Mass., Little, Brown and Co., 564 p., illus., tables, 1969.

Papers in this collection are reprinted from various sources published between 1941 and 1965. They are classified into the following sections: changes in populations, origin of species, reticulate evolution, major features of evolution, and evolution of Man. Papers pertinent to North American geology and of a general nature by American authors have been cited in volumes of Bibliography of North American Geology.—MCM

03434 **Eisenberg, D.; Kauzmann, W.** The structure and properties of water: New York and Oxford, England, Oxford Univ. Press, 296 p., illus., tables, 1969.

Some of the most important data on water are summarized, and the theories most effective in correlating these are presented. Some important properties, as thermal conductivity and surface tension, are omitted because they have not contributed to our understanding of the liquid structure; other properties, as infrared and Raman spectra, are covered in detail because they reveal so much about the structure of ice and liquid water. Chapter headings cover: the water molecule, the real vapor, ice, properties of liquid water, and models for liquid water. An addendum lists very recent articles and a few omitted in the bibliography.—ESL

03300 **Eisman, Donald B.** Gravity mapping proceeds—Unique effort by State: California Div. Mines and Geology Mineral Inf. Service, v. 22, no. 5, p. 82-84, illus., 1969.

Gravity anomalies and rock densities, generalized for the San Francisco Bay area, imply that the trend of geologic structure on shore carries out to sea. Aided by U.S. Army Map Service and Air Force Aeronautical Chart and Information Service, recent gravity measurements by the California Div. Mines and Geology can be used in marine geology, oil exploration, and fault location, and possibly for space programs. Using field information from various sources in a cooperative program dividing the state into 27 sections, colored geologic map sheets of San Francisco, Santa Cruz, and Alturas have been reprinted with gravity data.—GDC

Eldridge, H. B. *See* Flaherty, John P. 03140

03150 **Emerson, Alfred E.** A revision of the Tertiary fossil species of the Kalotermitidae (Isoptera): Am. Mus. Novitates, no. 2359, 57 p., illus., tables, 1969.

Eight genera and 12 species of Tertiary fossil imago casts of termites of Kalotermitidae Froggatt of the order Isoptera from Colorado, California, and foreign countries are redescribed. Numerous new characters of both genera and species are described, and the nomenclature, synonymics, systematics, comparisons, phylogenics, geographical distribution, ecology, and evolution of the fossil genera and species are discussed.—KAF

03522 **Emery, K. O.** A coastal pond studied by oceanographic methods: New York, Am. Elsevier Publishing Co., 80 p., illus., tables, 1969.

Many of the problems of oceanography can be studied in the model oceans of coastal ponds; a study of Oyster Pond, Cape Cod, Mass., is reported here as an example. The

north end is a kettle left by melting of buried ice in the Buzzards Bay moraine, and on the south a sand and gravel bar separates the pond from Vineyard Sound. Seismic profiles and spot soundings were used to reveal bottom topography. Sediment study included grain-size distribution, mineral composition, organic matter, stable carbon isotopes, amino acids, gases, subsurface sediments. Other studies included water and life.—ESL

03414 **Emrich, Grover H.; Merritt, Gary L.** Effects of mine drainage on ground water: Ground Water, v. 7, no. 3, p. 27-32, illus., tables, 1969.

Coal mining in Appalachia has degraded both surface and ground water. Oxidation of the pyrite associated with coal produces a high iron and sulfur concentration and a low pH in the water, which either flows directly into streams or moves into ground water. The pollution does not stop when mining stops. A detailed study of the effects of coal mining on ground water was conducted in the Toms Run drainage basin, Pennsylvania. The Mississippian-Pennsylvanian beds form a multiaquifer system. The acid mine drainage moves down from strip mines by oil and gas wells to the aquifers, then down dip to discharge as springs.—ESL

03424 **Engdahl, Eric R.; Flinn, Edward A.** Remarks on the paper "Early reflections of P'P' as an indication of upper mantle structure", by R. D. Adams [1968]: Seismol. Soc. America Bull., v. 59, no. 3, p. 1415-1417, illus., 1969.

Many of the arrivals identified by Adams (ibid., v. 58, p. 1933-1947, 1968) as upper mantle reflections of PKPPKP may in fact be attributed to SKKKP. Alternative explanations of apparent upper mantle reflections must be carefully excluded before physical interpretations concerning the structure of the Earth are inferred.—KAF

03606 **Epis, Rudy C.** Proposed Florissant Fossil Beds National Monument: Mines Mag., v. 59, no. 5, p. 10-13, illus., 1969.

A bill has been introduced in the U.S. Senate to make a National Monument out of the Florissant Lakebeds which occupy a small, elongate basin 15 miles northwest of Pikes Peak in Teller County, Colo. The beds contain a prolific assemblage of delicately preserved fossil plants and insects, they are less than 150 feet thick, and consist of a heterogeneous series dominantly composed of volcanic detritus.—KAF

03415 **Ergin, Kazim.** Observed intensity-epicentral distance relations in earthquakes: Seismol. Soc. America Bull., v. 59, no. 3, p. 1227-1238, illus., tables, 1969.

The observed intensity-distance relation for a number of earthquakes indicate that these curves fit one of the curves given by a formula. There are earthquakes with n = 5 for which the curve has an inflection point at some distance. This change in slope is explained by the arrival of body waves totally reflected from some discontinuity within the crust, the M-discontinuity and discontinuities within the upper mantle, as well as the concentration of rays resulting from the focusing effect of the increase in velocity gradient also in the crust or the upper mantle; the M-discontinuity has the largest contribution. There are cases where the decay of intensity with distance is azimuth dependent, which may be attributed to crustal structure being different in different directions. This type of reasoning should help to explain why earthquakes in eastern Canada and Missouri are felt over very large distances at some azimuths.—*from* Author's abstract

03168 **Esker, George C., 3d.** Biostratigraphy of the Cretaceous-Tertiary boundary in the East Texas Embayment based on planktonic Foraminifera [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3788B, 1969.

03295 **Estes, Richard.** The fossil record of amphiumid salamanders: Breviora, no. 322, 11 p., illus., 1969.

Proamphiuma cretacea from the late Cretaceous Hell Creek Formation in McCone County, Montana, and *Amphiuma jepseni* from the Paleocene Polecat Bench Formation in Park County, Wyoming, are described and illustrated. Widespread transgres-

sive Cretaceous seas provided extensive coastal plains and abundant shallow-water riparian habitats, and may have been a major factor in the evolution of amphiumids and other elongated, aquatic salamanders.—*from* Author's abstract

03296 **Estes, Richard.** Relationship of two Cretaceous lizards (Sauria, Teiidae): Breviora, no. 317, 8 p., illus., 1969.

Peneteius aquilonius, n.gen., n.sp., from the late Cretaceous of Montana, is a small teiid lizard with complex cheek teeth. It most closely resembles the modern South American teiids *Dicrodon* and *Teius* and also shows resemblance to the large Cretaceous teiid *Polyglyphanodon* from Utah. *Chamops segnis* Marsh, from the late Cretaceous of Wyoming, resembles the modern teiid *Callopistes maculatus*. *Meniscognathus altmani* Estes, from the same locality as *Chamops*, may be related to the modern teiids *Cnemidophorus* and *Kentropyx*. These resemblances indicate that three distinct groups of primitive teiids living today in South America were in existence in North America during late Cretaceous time.—Author's abstract

02990 **Ethington, R. L.; Schumacher, Dietmar.** Conodonts of the Copenhagen Formation (Middle Ordovician) in central Nevada: Jour. Paleontology, v. 43, no. 2, p. 440-484, illus., table, 1969.

A sparse but diverse fauna of conodonts is described from the middle (limestone) and upper (black shale) members of the Copenhagen Formation at and near the 400-ft-thick type section on the east flank of Monitor Range. The 66 taxa include two new but unnamed form genera and six new named species. The fauna is dominated by the *Dichognathus typicus-Oistodus abundans-Phragmodus undatus* association. *Belodina monitorensis*, n.sp., *Pygodus*, *Haddingodus*, polyplacognathids, and the two new genera characterize the middle member; *Icriodella*, *Sagittodontus*, and *Polyplacognathus ramosus* are represented in the meager fauna of the upper member. Conodont evidence supports previous assignments of the middle member to the upper Ashby-lower Porterfield Stage and of the upper member to the Wilderness Stage.—VMJ

Euler, Robert C. *See* Fowler, Don D. 03579

Evans, E. D. *See* Bray, E. E. 03575

03341 **Evans, Howard T., Jr.** Structural studies on isopoly and heteropoly complexes [abs.]: Zeitschr. Kristallographie, v. 128, nos. 3-6, p. 424-425, 1969.

Evans, Roger J. *See* Colbeck, S. C. 03441

03169 **Everett, Ardell Gordon.** Petrology and trace element chemistry of the Carmel Formation (Jurassic), Iron Springs mining district, Utah [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3788B-3789B, 1969.

Ewing, M. *See* Burk, C. A. 03107

03518 **Eyde, Richard H.; Bartlett, Alexandra; Barghoorn, Elso S.** Fossil record of *Alangium*: Torrey Bot. Club Bull., v. 96, no. 3, p. 288-314, illus., tables, 1969.

The fossil record of *Alangium*, including pollen and fruit remains and some hotly debated leaf impressions, shows that sect. Marlea extended into Europe and North America during much of the Cenozoic. European paleobotanists now tend to assign *Alangium*-like leaf impressions to Stereuliccae; however, most pollen and fruit remains undoubtedly belong to *Alangium*. Fossil fruits from the brown coal at Brandon, Vermont, and almost identical fruits from the brown coal of Salzhausen, Germany, resemble fruits of *A. platanifolium*, the modern species most tolerant of severe winter conditions. In marked contrast, fossil pollen grains from Vermont and Germany compare closely with those of *A. kurzii*, which now ranges from warm-temperate to tropical regions of southeast Asia. An appendix provides details of pollen morphology for *Alangium* species.—*from* Authors' abstract

03086 **Eyer, Jerome A.** Gannett Group of western Wyoming and southeastern Idaho: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1368-1390, illus., 1969.

The 5,000-ft-thick Gannett Group, confined to the thrust belt of southeastern Idaho, western Wyoming and northeastern Utah, overlies the marine Jurassic Stump Sandstone and is overlain by the Cretaceous marine lower Tygee Member of the Bear River Formation. In ascending order, the 5-unit Gannett consists of the Ephraim Conglomerate, Peterson Limestone, Bechler Formation, Draney Limestone, and a mudstone unit herein designated the Smoot Formation. Except for the lower part of the Ephraim, which contains Late Jurassic marine mollusca, all units of the Gannett contain charophytes and fresh-water ostracods of Aptian to Albian age.—BHK

03468 **Fahey, Joseph J.** Memorial of Waldemar Theodore Schaller—August 3, 1882-September 28, 1967: Am. Mineralogist, v. 54, nos. 3-4, p. 638-642, portrait, 1969.

03271 **Fahrig, W. F.** Geology, Lac Cambrien (west half), Quebec: Canada Geol. Survey Map 1223A, scale 1:253,440, text in English and French, 1969.

Basement rocks of the Cambrien Lake area are Archean pre-Kaniapiskau Group and Proterozoic Kaniapiskau Group; they have been cut by a number of northeasterly-trending basement faults, movement of which was predominantly normal. Northwesterly striking folds and thrust faults dominate the structure of Proterozoic rocks in the northeast corner of the area; major structure is a synclinorium. The intensely deformed zone north from Shale Falls is structurally similar to the Knob Lake section but probably contains a much thinner iron-rich section.—MCM

03392 **Farrell, W. E.** A gyroscopic seismometer—Measurements during the Borrego earthquake: Seismol. Soc. America Bull., v. 59, no. 3, p. 1239-1245, illus., 1969.

The gyro seismometer, consisting of two counter-rotating pendulous Nordsieck gyroscopes, permits separation of tilts from horizontal motion. Sensitivity is limited by the accuracy with which the gyro orientation can be measured, about 1 arcsecond rms in a 0.5 Hz bandwidth. This instrumental noise level is equivalent to ground tilts of about 1 arcsecond and ground velocities of about 0.1 cm per sec. Peak values in the instrumental pass band (0 to 0.5 Hz) of the tilt and horizontal velocity during the Borrego Mountain, California, earthquake of April 9, 1968, were 1 cm per sec and 10 arcseconds respectively. In La Jolla, 115 km from the epicenter, the static displacement and tilt were less than 1 cm and 0.1 arcsecond (5×10^{-7} radian).—Author's abstract

03485 **Faure, Gunter; Kovach, Jack.** The age of the Gunflint Iron Formation of the Animikie Series in Ontario, Canada: Geol. Soc. America Bull., v. 80, no. 9, p. 1725-1735, illus., tables, 1969.

A Rb-Sr isochron age of 1635 ± 24 m.y. was obtained for whole-rock samples from the Gunflint Iron Formation and the Rove Formation in Ontario, using a value of 1.39×10^{-11} yr^{-1} for the decay constant of Rb-87. This date may be interpreted as being approximately the time of deposition and diagenesis of the Animikie Series in the Thunder Bay district or as the time of low-grade metamorphism. [The former interpretation is considered the more likely in view of the apparent lack of metamorphism in the Gunflint Iron Formation and in the underlying grantic basement.]—*from* Authors' abstract

03465 **Faust, George T.** Memorial of Alfred Cary Hawkins—June 15, 1887-March 30, 1954: Am. Mineralogist, v. 54, nos. 3-4, p. 619-625, portrait, 1969.

03572 **Federal Council Sci. and Technology; Pecora, W. T.** (chairman, *ad hoc* Interagency Working Group for Earthquake Research). Scope of earthquake research of agencies within the Government of the United States, *in* CENTO conference on earthquake hazard minimization, Ankara, 1968: Ankara, Turkey, U.S. Econ. Coordinator CENTO Affairs, p. 155-168, 1969.

In the Department of Commerce, the ESSA earthquake-research program is shared by the Earth Sciences Laboratories, the Coast and Geodetic Survey and the Atlantic and Pacific Oceanographic Laboratories. The Bureau of Standards does earthquake-related research in design techniques and building codes. Most of the Interior Department's earthquake-research program is conducted by various units of the Geologic Division of the U.S. Geological Survey. The Bureau of Reclamation conducts research in earthquake engineering and the Bureau of Mines conducts relevant research programs. The Atomic Engineering Commission has an extensive program in earthquake-related investigations such as seismology and geophysics. In the Department of Defense, both the Advanced Research Projects Agency and the Corps of Engineers have investigations that support earthquake research, mainly on underground nuclear explosion detection.—KAF

Feitham, William. *See* Gedney, Larry. 03422

Ferguson, G. E. *See* Vice, R. B. 03430

03580 **Ferrians, Oscar J., Jr.; Kachadoorian, Reuben; Greene, Gordon W.** Permafrost and related engineering problems in Alaska: U.S. Geol. Survey Prof. Paper 678, 37 p., illus., tables, 1969.

The permafrost region of Alaska, 85 percent of the State, is characterized by a variety of geomorphic features—patterned ground, pingos, thaw lakes, beaded drainage, thaw or thermokarst pits, and muck deposits. Known permafrost thickness ranges from about 1,300 feet near Barrow to less than a foot at the southern margin. Permafrost distribution is controlled by climatic, geologic, hydrologic, topographic, and botanic factors. The extensive permafrost region of Alaska poses special engineering problems for design, construction, and maintenance of structures. Lack of knowledge has resulted in tremendous maintenance costs and even in relocation or abandonment of highways, railroads, and other structures. Special engineering procedures should be used to minimize disruption of natural environments and to provide economical and sound methods of developing natural resources.—*from* Authors' abstract

Fischer, A. G. *See* Burk, C. A. 03107

03453 **Fisher, D. Jerome.** Albite, variety cleavelandite, and the signs of its optic directions—Addendum [to 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 569-570, table, 1969.

Certain optical properties of the Chesterfield, Mass., cleavelandite were detailed in the 1968 paper (ibid., v. 53, p. 1568-1578). Unit-cell dimensions determined by X-ray powder diffraction (Wright and Stewart, 1968) are given here, and corrections to the original paper listed.—ESL

03140 **Flaherty, John P.; Eldridge, H. B.** Activation analysis of trace metals in oil [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 27-28, 1969.

Fleischer, Michael. *See* Richmond, W. E. 03511

Flessa, K. Walter. *See* Bretsky, Peter W. 02998

Flinn, Edward A. *See* Engdahl, Eric R. 03424

03655 **Flory, D. A.; Oro, J.; Louis, M. C.** Le composition isotopique du carbone de certains hydrocarbures optiquement actifs contenus dans un petrole: Inst. Français Petrole Rev., v. 24, no. 3, p. 368-369, 1969.

Determination of the C-12 and C-13 content of petroleum is important in determining origin of mineral oils; their provenance from marine and continental organisms can be indicated as well as the role played by the lipids which they contain. The triterpenes, which are probably derived from natural triterpenoides in the carbonate structure of the original molecules, are of particular importance. This type of

hydrocarbon is endowed with a rotation capacity and it is on these that isotopic measurements should be made. In this note, results obtained on a fraction of crude oil from Mirando, Texas, having a rotation capacity of + 36° are discussed. Because isotope relations change through the course of geologic time, other markers (fatty acids, amino acids, alcohols, ketones) must be considered also.—VSN

03057 **Ford, Trevor D.; Breed, William J.; Downie, Charles.** Preliminary geologic report of the Chuar Group, Grand Canyon, Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 114-121, illus., 1969.

The Lower Chuar division in the Grand Canyon consists of dolomitic limestone, calcareous sandstone, and dark shales while sediments of the Upper Chuar are much more varied. Most of the Chuar stromatolite horizons in Nankoweap Valley lack positive shallow-water or dessication structures in either the stromatolite beds or the adjacent shales; no evidence to indicate definitely an intertidal environment has been seen. In some of the shales of the Upper Chuar, large numbers of small carbonaceous disks were found. All the disks are smaller than Walcott's (1883, 1899) *Chuaria*, which he thought to be a brachiopod. Data suggest that *Churia* and *Fermoria* may be congeneric and rather than brachiopods are possibly (1) chitinous foraminifera, (2) megaspores, (3) large microplankton or (4) noncalcareous algae of unknown affinities.—KAF

Fortsch, David. *See* Hopkins, Marie L. 03553

03378 **Foster, Fred W.** Evaluation and potential of Gemini photography, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. H2-H3 [1969?].

Problems related to use of Gemini photographs are: variation in obliquity, scale changes, film-introduced tints, and lack of detail. The photographs have a very important function as illustrative material, for delineation of detail over large areas, and for indexing larger scale satellite photography.—ESL

03651 **Foster, Robert.** General geology: Columbus, Ohio, Charles E. Merrill Publishing Co., 630 p., illus., tables, 1969.

This introductory geology text attempts to provide a broad overview of geology for a general education student. The book is in four parts: Part 1, minerals and rocks, includes an introduction; atoms, elements and minerals; igneous rocks and volcanoes; weathering and sedimentary rocks; metamorphic rocks; and mineral resources. Part 2, erosion, includes downslope movement of surface material; work of rivers and development of landscapes; geologic processes in arid regions and wind work; geologic work of ice; shorelines; ground water and water resources. Part 3, structural geology, includes earthquakes and the Earth's interior; features of the crust; the continents; the oceans and continent-ocean borders; origins of crustal structures; and continental drift. Part 4, earth history, includes principles of historical geology; early history of the Earth—astronomical aspects of geology; geologic history of middle North America; and development of life.—JNR

03015 **Four Corners Geological Society.** Geology and natural history of the Grand Canyon region, 5th field conference, Powell Centennial River Expedition, 1969: [Durango, Colo.] Four Corners Geol. Soc., 212 p., illus., 1969.

This volume is a guidebook for the field conference sponsored by the Four Corners Geological Society commemorating the centennial of Major John Wesley Powell's expeditions down the Colorado River. The stratigraphy, economic geology and natural history of the Grand Canyon and adjoining regions are discussed in 20 papers which are cited separately.—KAF

Fowler, Catherine S. *See* Fowler, Don D. 03579

03579 **Fowler, Don D.; Euler, Robert C.; Fowler, Catherine S.** John Wesley Powell and the anthropology of the Canyon Country: U.S. Geol. Survey Prof. Paper 670, 30 p., illus., 1969.

From 1868-1879, John Wesley Powell devoted part of his time to a study of Indians of the Canyon Country—areas of Utah, western Colorado, northern Arizona, and northwestern New Mexico that are drained by the Colorado River and its tributaries. In 1879 Congress provided money for completion of Powell's ethnological work; this led to creation of the Smithsonian Institution's Bureau of American Ethnology. More than 250 archeological sites have been found below the rims of Marble and Grand Canyons; 37 sites are along Powell's river route, but only eight are recorded in Powell's reports or in journals of those who went with him. Prehistoric human history of the region is described briefly by R. C. Euler, origins of Indians are portrayed by D. D. and C. S. Fowler, and brief accounts are presented, using quotations from Powell's notes, on Indian customs, practices, and beliefs.—*from* Authors' abstract

03587 **Fox, Paul J.; Pitman, W. C., 3d; Shepard, Frank.** Crustal plates in the central Atlantic—Evidence for at least two poles of rotation: Science, v. 165, no. 3892, p. 487-489, illus., 1969.

A fracture zone that offsets the Mid-Atlantic Ridge at 24° N., 45° W. was traced westward over a distance of 840 km. The radius of curvature of the fracture zone changes at about 47°45' W.; this suggests that the fracture zone was generated by rotation of crustal plates about at least two sequential poles.—Authors' abstract

Frankel, M. L. *See* Beaver, J. A. 03413

03373 **Franklin, A. G.** Waters of the land—Relation of river drainage to land forms, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. F10-F11, illus. [1969?].

This photograph covers the Midland, Tex., area. The surface is covered by alluvial and windblown deposits and the strata are nearly horizontal, but oil and gas have been found in structures having very little surface expression. Anomalous drainage patterns or fractures might indicate a buried structure.—ESL

03391 **Fraser, George D.; Waldrop, Henry A.; Hyden, Harold J.** Geology of the Gardiner area, Park County, Montana: U.S. Geol. Survey Bull. 1277, 118 p., illus., tables, geol. map, 1969.

The Gardiner area, 52-sq mi in the southwestern Gardiner 15-minute quadrangle, is divided into two blocks by the high angle Gardiner reverse fault: the Beartooth Mountains of crystalline Precambrian rocks stripped of sedimentary cover and veneered by Eocene deposits, and the Yellowstone Valley of 10,000 feet of Paleozoic and Mesozoic rocks with a veneer of Cenozoic rock. Poorly exposed lower Precambrian rocks have a complex history from prolonged deposition to prolonged uplift and erosion. Measured sections of Cinnabar Mtn. and adjacent areas are included for understanding of the structurally modified stratigraphy. Coal bearing lands are classified. Coal deposits in the Cretaceous Eagle Sandstone, cropping out locally, have never been successfully mined. Landslides of Holocene age move into Yellowstone and Gardner Valleys from Sepulcher Mtn. and are responsible for superficial fissures and normal faults.—JNR

03656 **Fraser, Gordon S.; James, Alan T.** Radiographic exposure guides for mud, sandstone, limestone, and shale: Illinois Geol. Survey Circ. 443, 19 p., illus., table, 1969.

Guides relating kilovoltage, exposure conditions, kind of material and its thickness, to radiographic film density were prepared for marine mud, sandstone, limestone, and shale. Individual step wedges of each material were radiographed at different kilovoltages and exposures; resulting film densities measured were related in graph to sample thickness. A film density of 1.5 was chosen for guides to relate exposure to sample thickness at various kilovoltages. Curved isopotential lines derived for geological materials indicate that some kilovoltages, satisfactory for thin specimens,

may give similar results for thicker ones with only slightly longer exposure; others cannot, regardless of exposure time. Amount of curvature of the isopotential lines seems proportional to relative porosity of the rock materials X-rayed. Further studies may greatly expand the usefulness of radiographs in the analysis of earth materials.—*from* Authors' abstract

03447 **Frazer, Jane Z.; Keil, Klaus; Reid, Arch M.** Lattice parameters of kamacite by the Kossel technique: Am. Mineralogist, v. 54, nos. 3-4, p. 554-559, illus., table, 1969.

Determination of the cell dimension by divergent beam X-ray diffraction was tested on kamacite from six meteorites.—Authors' abstract

03343 **Freed, R. L.; Peacor, Donald R.** Determination and refinement of the crystal structure of margarosanite, $PbCa_2Si_3O_9$ [with German abs.]: Zeitschr. Kristallographie, v. 128, nos. 3-6, p. 213-228, illus., tables, 1969.

The crystal structure of margarosanite with $a = 6.768A \pm .004$, $b = 9.575A \pm .004$, $c = 6.718A \pm .005$, $\alpha = 110.36° \pm .03$, $\beta = 102.98° \pm .04$, $\gamma = 83.02° \pm .05$, with space group $P\bar{1}$, was solved by application of the minimum function to P(xyz), and use of heavy-atom techniques. This yielded a trial structure, refined by a least squares method. The structure has these principal features: (1) planes of tetrahedral sites alternate with planes of calcium sites between sheets of close-packed oxygen atoms parallel to (101); (2) Pb and Ca are ordered; (3) Ca(1) polyhedra form an infinite edge-sharing chain parallel to [101] and Pb and Ca(2) sites alternate along the edge of this chain; (4) tetrahedral sites form three-membered rings linked to the Ca(1) polyhedral chain; and (5) the two Ca atoms have 6-fold coordination and the Pb atom has 7-fold.—*from* Authors' abstract

03161 **Freeman, Charles Edward, Jr.** A pollen study of some post-Wisconsin alluvial deposits in Dona Ana County, southern New Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3635B-3636B, 1969.

03499 **Freeman, Tom.** Oscillatory porosity history of poikilotopic dolostones: Geol. Soc. America Bull., v. 80, no. 9, p. 1879-1880, illus., 1969.

Calcite cement in poikilotopic dolostones is postdolomite in origin. From this an oscillatory porosity history emerges: porosity *decreased* with compaction (and in some cases cementation), *increased* with dolomitization, *decreased* with calcite cementation, and locally *increased* with outcrop leaching.—Author's abstract

03509 **Frey, M. G.; Grimes, W. H.** Bay Marchand-Timbalier Bay-Caillou Island salt complex, Louisiana: South Texas Geol. Soc. Bull., v. 9, no. 8, p. 7-30, illus., 1969.

This salt complex, about 28 miles long and 12 miles wide, may be part of a much longer salt feature extending both east and west. The mother salt bed, of probable Late Triassic-Early Jurassic age, is buried to depths of 40,000 to 50,000 feet, whereas tops of the individual domes along the trend rise to within 2,000 to 3,000 feet of the surface. Production to date on this three-field complex has exceeded 0.7 billion bbl oil. Oil reserves are estimated to range from 0.75 to 1 billion bbl. In addition, significant gas reserves are present. Hydrocarbon accumulation occurs in sands of Pleistocene through late Miocene age at depths from 1,000 to below 20,000 feet. A wide variety of traps include supradomal arching, shale, and salt truncations, stratigraphic traps, and those resulting from faults. Production was established on this complex in 1933. The total production for 1967 was about 97 million bbl.—*from* Authors' abstract

Frey, Robert W. *See* Bell, Bruce M. 02983

Friedman, Gerald M. *See* Sanders, John E. 03480

03564 **Friedman, Gerald M.** Trace elements as possible environmental indicators in carbonate sediments, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 193-198, illus., tables, 1969.

The distribution of the trace elements Ba, Fe, and Mn was investigated in carbonate sediments. Correlations were found between the Ba, Fe, and Mn concentrations in the carbonate sediments and molluskan shells studied, and the depositional environment. The Ba and Mn content of fresh water samples and the Mn and Fe content of lagoonal (brackish water) samples exceed that of marine samples. The Ba content of lagoonal samples tends to be less than that of fresh water samples.—KAF

03573 **Friedman, Gerald M.** (editor). Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, 209 p., illus., tables, 1969.

This volume contains papers presented at a symposium on "Depositional environments of carbonate rocks" held in Los Angeles on April 13, 1967, by the American Association of Petroleum Geologists. Deep-water, transitional and shallow water environments of carbonate deposition are discussed in the nine papers cited separately.—KAF

Friedman, Irving. *See* Murata, K. J. 03592

03585 **Frondel, Judith W.** Fossil elemi species identified by thin-layer chromatography: Naturwissenschaften, v. 56, no. 5, p. 280, illus., 1969.

Thin layer chromatograms of fossil resins from England, the Baltic, Ecuador, and Mexico resemble each other, substantiating genetic relationships. The method of making the chromatograms is described.—ESL

03501 **Fullagar, Paul D.; Bottino, Michael L.** Tertiary felsite intrusions in the Valley and Ridge province, Virginia: Geol. Soc. America Bull., v. 80, no. 9, p. 1853-1857, illus., 1969.

Porphyritic albite-felsite sills and dikes are exposed in west-central Virginia in Highland County. Two biotite separates have K-Ar ages of 46.9 ± 1.1 and 47.2 ± 1.3 m.y. Seven whole-rock and the two biotite separates were analyzed for Rb, Sr, and Sr isotopic composition. These results indicate that the felsite is 37 ± 3 m.y. old; because of the very low percentage of radiogenic Sr-87 in the whole-rock and biotite samples the Rb-Sr age is considered to be the less reliable. These results establish a location for Eocene igneous activity in the south-central Appalachian area. The period of time during which igneous activity occurred along the 38th-parallel lineament has been extended considerably. Highland County may have been at least one of the sources of volcanic ash found in the Coastal Plain of North America.—*from* Authors' abstract

03028 **Gafford, Edward Leighman, Jr.** Experimental determination of partition coefficients for calcium, strontium, and barium in aragonite precipitated from sea water at low temperatures [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4225B, 1969.

Galle, O. K. *See* Angino, E. E. 03320

Gangloff, Roland A. *See* McKee, Edwin H. 03117

Gardner, Marjorie. *See* Schubel, J. R. 03357

03504 **Gauri, K. Lal; Noland, Anne V.; Moore, Bruce.** Structurally deformed Late Ordovician to Early Silurian strata in north-central Kentucky and southeastern Indiana: Geol. Soc. America Bull., v. 80, no. 9, p. 1881-1886, illus., 1969.

Amidst the vast expanse of horizontally disposed Paleozoic strata in the Interior Lowlands, structurally deformed early Paleozoic beds are exposed in certain tributaries of the Ohio River. The deformation ranges from weak folding to overthrusting. The Brassfield Limestone of Early Silurian age contains breccia of an earlier age. The Brassfield Limestone itself is brecciated in the region of structural disturbance. The structural disturbance and the brecciation, though of different ages, appear to be associated with probable periodic upheavals of the Cincinnati Arch during Llandoverian (Early Silurian) to Wenlockian (Middle Silurian) times.—Authors' abstract

03422 **Gedney, Larry; Berg, Eduard; Pulpan, Hans; Davies, John; Feltham, William.** A field report on the Rampart, Alaska earthquake of October 29, 1968: Seismol. Soc. America Bull., v. 59, no. 3, p. 1421-1423, illus., 1969.

The largest earthquake in recent years in interior Alaska occurred on October 29, 1968, near the village of Rampart on the Yukon River. Focal coordinates were lat 65.38° N., long 150.02° W., depth 30 km. The event was felt strongly at Manley Hot Springs, Tanana, Nenana, and Fairbanks (the last being 130 km away), and was discernible to persons at rest in Anchorage, 480 km away. No serious structural damage was inflicted, nearly all houses in Rampart being of log construction. A definite magnitude has not yet been established, but it is probably in the range from 6.5 to 6.75. The most intense aftershock was at 00:25 (GMT) the following afternoon, with M = 5.5. Surface effects—landslides, slumping, fissuring—were widespread.—DBV

03519 **Gensel, Patricia; Kasper, Andrew; Andrews, Henry N.** *Kaulangiophyton*, a new genus of plants from the Devonian of Maine: Torrey Bot. Club Bull., v. 96, no. 3, p. 265-276, illus., 1969.

This is the second in a series of studies on Early Devonian plants from northern Maine. The fossil described here comes from the Trout Valley Formation and is probably of Lower Devonian age. *Kaulangiophyton akantha*, n. gen., n.sp., was a plant that attained a height of several decimeters; the axes are 5 to 9 mm in diameter with trailing and upright portions that are divided by numerous wide dichotomies or H-branches; they bore sparsely distributed, stout spines of about 2 mm length. The upright axes included occasional fertile zones with stalks, each of which bore a terminal sporangium.—Authors' abstract

03055 **Gerrard, Thomas A.** Stratigraphy of the Fort Apache Member, Supai Formation (Permian), east-central Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 174-180, illus., 1969.

The Fort Apache Member of the Supai Formation is distinguished most easily from enclosing clastic red beds by its dominantly carbonate lithology, stratigraphic position, and contained fauna. Because of the dominant dolomite lithology in the Fort Apache Limestone Member designated by Winters (1963), it is recommended that the rock-stratigraphic unit be referred to as the Fort Apache Member of the Supai Formation. Evidence strongly supports a correlation of the Fort Apache along the Mogollon Rim with the 7 to 10 ft carbonate horizon in the A Member designated by McKee (1945) in Oak Creek Canyon. Distinct limestone, dolomite and evaporite-dolomite lithofacies of the Fort Apache Member have been distinguished on the basis of quantitative petrographic studies.—KAF

03474 **Gibbs, G. V.; Ribbe, P. H.** The crystal structures of the humite minerals—[Pt.] 1, Norbergite: Am. Mineralogist, v. 54, nos. 3-4, p. 376-390, illus., tables, 1969.

The crystal structure of norbergite from Franklin, N. J., was refined by least-squares techniques to R = 0.052 using 867 intensities weighted by the range-estimate method. The structure is based on a slightly distorted hexagonal close-packed array of anions with one-half the octahedral sites occupied by Mg and one-twelfth the tetrahedral sites by Si. F is ordered in the array and bonded to three Mg. Comparable bond lengths involving F and O indicate that the radius of F is about 0.11A smaller than O. The dominant structural unit in norbergite is a zigzag chain of edge-sharing octahedra lying parallel to z. The distortions from an ideal hexagonal close-packed model can be explained qualitatively in terms of cation repulsion across shared polyhedral edges. The Si-O bond lengths opposite shared edges are longer than those opposite unshared edges of the tetrahedron.—*from* Authors' abstract

Gibbs, G. V. *See* Jones, Norris W. 03475

03328 **Giblin, P. E.** Sault Ste. Marie district, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 2: Ontario Dept. Mines Misc. Paper 24, p. 1-24, illus., 1969.

Three properties were examined and are described, exploration and mining activities are summarized, new maps and literature are listed, and new information added to the files is tabulated.—ESL

Gilbert, Freeman. *See* Backus, George. 03420

03185 **Gilmore, Robert Snee.** High-pressure, ultrasonic study of elastic properties and equations of state of fifteen materials [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3796B-3797B, 1969.

03294 **Gilmour, A. E.** Precise temperature measurements in the Cayman Trench: Deep-Sea Research, v. 16, no. 2, p. 197-203, illus., tables, 1969.

Temperature measurements made on a N-S section across Cayman Trench are described and specifications of the precise bathythermograph with quartz crystal temperature sensors are given. Results reveal that water above 4300 m is stably stratified; below this the temperature gradient is within 2 percent of the adiabatic gradient and water stability is positive. Temperatures at deep stations for a given depth were bracketed in a range of less than 0.003°C corresponding to isotherm slopes of the order of 2×10^{-4}°C km^{-1}; irregularities were observed. The assumption that geothermal flux is being trapped below 4300 m, combined with the history of temperature increase, leads to an estimation of a mean geothermal flux of 2.3μ cal cm^{-2} sec^{-1}.—VSN

Glaessner, M. F. *See* Brooks, H. K. 03492

03493 **Glaessner, M. F.** Cycloidea, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R567-R570, illus.; addendum, p. R629, 1969.

Cycloidea Glaessner, 1928 is considered a crustacean superfamily of uncertain class and order. Seven genera, in three families, all benthonic forms, occur in Carboniferous and Triassic marine and brackish sediments of the northern hemisphere. Distinguishing features are: a small shieldlike hemispherical carapace; ventral surface with a large triangular median plate and seven pairs of narrow radiating plates terminating in biramous(?) protopodites, head with one pair of antennae, fused to thorax; reduced abdomen. *Cyclus* was considered a branchiuran crustacean but the resemblance is superficial as are resemblances to chelicerates and malacostracans, although *Halicyne* (see addendum) has chelicerate-like legs and other features.—VMJ

03359 **Globensky, Yvon.** Geology of Drummondville area (eastern part), Arthabaska, Drummond and Richmond Counties [also French edition]: Quebec Dept. Nat. Resources Prelim. Rept. 569, 11 p., illus., tables, geol. map, 1969.

The map-area is about halfway between Montreal and Quebec. The rocks are lower Paleozoic in age and have been grouped into 11 formations. Two intrusions of dioritic gabbro are of probable Ordovician age. Structures in the map-area include an extension of the northeastern end of the Sutton anticlinorium and a fault separating this from the Caldwell Group. Results of chemical analyses of stream sediments are tabulated and shown on a map.—ESL

03360 **Globensky, Yvon.** Geology of Drummondville area (west part), Drummond and Arthabaska Counties [also French edition]: Quebec Dept. Nat. Resources Prelim. Rept. 570, 17 p., illus., tables, geol. map, 1969.

The map-area lies in the Eastern Townships. Consolidated rocks are Paleozoic, with the exception of a Mesozoic dike, and have been grouped into five units. Two folds, one involving Unit 1, and the other Units 4 and 5, are present. The Champlain fault crosses the northwest corner. Sand and crushed stone are the only economic products. Results of chemical analyses of stream sediments are tabulated and shown on a map.—ESL

Godby, E. A. *See* Hood, Peter. 03075

Goddard, Edwin N. *See* Kelly, William C. 03297

03071 **Goldman, Harold B.** (editor). Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, 130 p., illus., tables, geol. map, 1969.

This volume consists of reports for the San Francisco Bay Conservation and Development Commission on San Francisco Bay geology, mineral deposits, earthquake hazards, and fill problems.—KAF

03072 **Goldman, Harold B.** Geology of San Francisco Bay, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 11-29, illus., tables, geol. map, 1969.

Engineering problems associated with the filling of the bay as urban expansion grows, are a result of the poor foundation characteristics of the thick layer of mud or silty clay that underlies the bottom and margin of much of the bay. Variability in the thickness and engineering properties as well as the slope and configuration of the bedrock surface, complicates the difficulty in engineering fills. The bay is bounded by seismically active faults. The soft, water-bearing sediments, such as bay mud, may be expected to react strongly to earthquake-generated shocks. The geology of the recent sediments in the bay is incompletely known. Thickness and extent of the geologic formations underlying the bay are known only through limited boring reports.—*from* Author's abstract

03073 **Goldman, Harold B.** Salt, sand, and shells—Mineral resources of San Francisco Bay, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 31-40, illus., tables, 1969.

Sand, an important source of hydraulic fill in San Francisco Bay, occurs in or immediately adjacent to existing current channels at a number of places between the confluence of the Sacramento and San Joaquin Rivers and in the Golden Gate. Late Quaternary oyster shell deposits, which are exposed over a large portion of southern San Francisco Bay, constitute an important mineral resource. The shell deposits are actually thin, low grade, unconsolidated to weakly consolidated limestone deposits and are mainly used to manufacture cement. Salines in the bay are derived entirely from sea water. Common salt, magnesium compounds, artificial gypsum and bromine are produced.—KAF

02959 **Goll, R. M.** Classification and phylogeny of Cenozoic Trissocyclidae (Radiolaria) in the Pacific and Caribbean Basins, Pt. 2: Jour. Paleontology, v. 43, no. 2, p. 322-339, illus., 1969.

Three genera, *Tholospyris* Haeckel, *Giraffospyris* Haeckel, and *Dorcadospyris* Haeckel, are emended, and 21 species are described [from 54 samples from tropical Pacific deep-sea cores and Tertiary outcrops in the Antilles]. The following new species are proposed: *Tholospyris devexa, T. infericosta, T. procera, Giraffospyris annulispina, G. circumflexa, G. lata, G. laterispina* and *Dorcadospyris costatescens.*—Author's abstract

03648 **Gonzalez-P., Gustavo C.** Reservoir study, Red Fork sandstone in the Oakdale Field, Woods County, Oklahoma: Shale Shaker, v. 19, no. 10, p. 170-179, illus., 1969.

This paper is a modification of an MS thesis entitled, "A geological engineering study of the Red Fork. . .". The Red Fork zone is a formation of the Pennsylvanian Cherokee Group, consisting of 60 feet of sandstones and sandy shales. The lower sand appears to be a channel filling. Three cross sections illustrate the stratigraphy of the Red Fork zone, and structure contour maps the structure at the Chester unconformity. Most of the text is devoted to petroleum engineering, including history of production and completion practices, reservoir fluid analysis and properties, calculation of original oil in place, and reservoir performance predictions.—ESL

Goodacre, A. K. *See* Weber, J. R. 03013

Gordus, Adon A. *See* Griffin, James B. 03310

Gordus, Adon A. *See* Wright, Gary A. 03556

02969 **Grant, A. C.** Some aspects of the bedrock geology of Hudson Bay as interpreted from continuous seismic reflection profiles, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 136-143, illus., 1969.

Continuous seismic reflection profiles indicate that the Paleozoic sedimentary rocks beneath Hudson Bay comprise a basinal structure. Regional strike determinations indicate north-south elongation of this basin, and the major topographic trends are considered to be a reflection of bedrock structure. In particular, the western slope of the 'central shoal' feature is a dip slope, and the eastern side is an erosional escarpment truncating the west-dipping beds. Structure imposed subsequent to the deposition of the Paleozoic sediments in Hudson Bay may have influenced the development of drainage features. These features were the centers of considerable drift accumulation during Pleistocene time.—Author's abstract

03311 **Gray, James T.** Glacial history of the eastern Mealy Mountains, southern Labrador [with French and Russian abs.]: Arctic, v. 22, no. 2, p. 106-111, illus., tables, 1969.

Two continental glaciations, both considered Wisconsin in age have been noted in the eastern Mealy Mountains. The earlier ice sheet reached a minimum elevation of 3,000 feet (925 m) and may have overtopped the summit plateaus of 4,000 feet (1,240 m). The ice moved from west to east. The vertical limit of the later ice sheet varied from 2,300 feet (710 m) in the west to 1,800 feet (555 m) in the east. Cirques were carved prior to both glaciations. The development of active glaciers with pronounced end moraines, subsequent to the second and later glaciation, was restricted to cirques oriented towards the east and southeast. Cirque glacier readvances have probably not occurred within the last few hundred years.—Author's abstract

02956 **Greeley, Ronald.** Basally "uncalcified" zoaria of lunulitiform Bryozoa: Jour. Paleontology, v. 43, no. 2, p. 252-256, illus., 1969.

Lunulitiform zoaria having only the frontal side preserved, or external molds of the basal side, have been described as having the basal side "uncalcified". Basally "uncalcified" forms are restricted to fossil specimens from the eastern (calcareous) part of the Gulf and Atlantic Coastal Plains. Several localities yield normal (solid) zoaria and zoaria lacking basal sides within the same species; stages of development from normal to basally "uncalcified" forms are demonstrated for *Lunulites ligulatus* (Canu and Bassler). X-ray diffraction shows a mineralogic difference for the basal (aragonite) and frontal (calcite) sides. Basally "uncalcified" zoaria are believed to result from preferential leaching or solution of the basal aragonite and thus are not considered genetic. Species that were originally so described appear valid on the basis of other characters.—*from* Author's abstract

Greene, Gordon W. *See* Ferrians, Oscar J., Jr. 03580

03472 **Greenwood, W. R.; Reid, R. R.** The Columbia Arc—New evidence for pre-Tertiary rotation: Geol. Soc. America Bull., v. 80, no. 9, p. 1797-1800, illus., 1969.

Structural analysis of two areas in central Idaho indicates the presence of large, steep-plunging sigmoidal folds. These structures bend schistosity and early fold axes, and one of the structures is cut by Cretaceous quartz monzonite of the Idaho batholith. A large synkinematic orthogneiss body which intrudes the core of one of these folds has a weak schistosity parallel to the axial surface of the fold. The sigmoidal folds may be from latest Precambrian to early Cretaceous in age. These large sigmoidal folds are similar in style, attitude, and direction of tectonic transport to the much larger Cordilleran Orocline proposed by Carey (1958). The presence of the folds in central Idaho supports Carey's concept of translational rotation of the northwestern United States in response to deep crustal movements.—Authors' abstract

Greiner, H. R. *See* Lesperance, P. J. 03520

03621 **Grice, Charles R.** Grice field, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 70-74, illus., 1969.

03310 **Griffin, James B.; Wright, Gary A.; Gordus, Adon A.** Obsidian samples from archaeological sites in northwestern Alaska—A preliminary report: Arctic, v. 22, no. 2, p. 152-156, tables, 1969.

Neutron activation analyses of 102 obsidian specimens, mostly from the deeply stratified Onion Portage site on the Kobuk River, showed four Na-Mn groups, representing at least four obsidian sources. The geographic locations have not been identified as yet.—ESL

Griffin, James B. *See* Wright, Gary A. 03556

03547 **Griffin, W. L.** Geologic map of the Embarrass quadrangle, St. Louis County, Minnesota: Minnesota Geol. Survey Misc. Map M-6, scale 1:24,000, 1969.

03515 **Griffith, L. S.; Pitcher, Max G.; Rice, G. Wesley.** Quantitative environmental analysis of a Lower Cretaceous reef complex, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 120-138, illus., 1969.

Lower Cretaceous rudist reefs control facies distribution in the subsurface Edwards and Stuart City Formations in South Texas. Comparing the Cretaceous model and a Florida reef track—Florida Bay Recent model, a change in reef frame from rudists to corals is the principal difference but minor faunal components in back-reef sediments are similar. Rock samples are described quantitatively and compared vectorially. Parameters for analysis include components modified by textural and structural adjectives. A second factor analysis was run using only important faunal components as outlined by the factor score. Environments outlined by the two analyses are very similar. Microsedimentary structures and textures are important in environmental interpretation of facies containing extinct faunas.—*from* Authors' abstract

03077 **Griggs, D. T.** Earthquake mechanisms [abs.] (also French text), *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 235, 1969.

03304 **Griggs, G. B.; Carey, A. G.; Kulm, L. D.** Deep-sea sedimentation and sediment-fauna interaction in Cascadia Channel and on Cascadia Abyssal Plain: Deep-Sea Research, v. 16, no. 2, p. 157-170, illus., tables, 1969.

A unique environment has been created by transport of sediments from shallow water by turbidity currents and their deposition within Cascadia Channel in the northeastern Pacific. Thick organic-rich turbidity current deposits of postglacial age in Cascadia Channel contrast markedly with hemipelagic clays overlying Pleistocene sands of the adjacent abyssal plain on either side; the benthic animal population in the channel is four times as abundant. Burrowing organisms in Cascadia Channel have left well preserved burrows within successive turbidity current deposits. The variation of depth and frequency of burrowing has been correlated over a distance of 65 km within the Channel. The turbidity flows possibly create a unique environment in the Channel and the fauna is affected by differences in sediment size and composition and by increased supply of utilizable organic material.—*from* Authors' abstract

Grimes, W. H. *See* Frey, M. G. 03509

Griscom, Andrew. *See* Zietz, Isidore. 03483

03552 **Guilday, John E.** Small mammal remains from the Wasden Site (Owl Cave), Bonneville County, Idaho: Tebiwa, v. 12, no. 1, p. 47-57, illus., table, 1969.

A minimum of 7420 small mammals were counted from this cave. Fourteen rodents, 3 lagomorphs, and 2 or 3 small carnivores are represented. It may have been a

prehistoric owl roost; the guano is stratified. Small mammals typical of the area today occur throughout the stratigraphic section, suggesting the same semi-arid conditions prevailed. The upper layers contain a reduction of all numbers, suggesting a reduction of kill per predator-hour, and since prey was scarce, the predator population was thereby reduced; this affected the sedimentation rate in the cave. Variations were greater in pre-Mazama Ash time than later, suggesting climatic changes of greater magnitude.—HRC

03382 **Guillet, G. R.** Southern Ontario, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 4: Ontario Dept. Mines Misc. Paper 26, p. 1-28, illus., tables, 1969.

Most sectors of the mineral industry of southern Ontario continued to set records in 1968. Total mineral production from southern Ontario for 1967 was valued at 202,681,755 dollars, and exploration activity was high. Significant new information includes the presence of mercury in sulfide deposits, the conflict between producers of construction materials and urbanization, and the use of airborne radiation surveys as a possible mapping technique. Maps and literature published in 1968 by the Department of Mines are listed, four uranium properties examined are described, and recommendations for future exploration are made.—ESL

03615 **Guinan, M. A.** Cordona Lake (San Angelo, Tubb, Devonian), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 36-45, illus., 1969.

03048 **Guitjens, Johannes Caspar.** The effect of soil-moisture hysteresis on the flow of water into a gravity well [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4251B-4252B, 1969.

Gutschick, Raymond C. *See* Rodriguez, Joaquin. 03105

03291 **Gutschick, Raymond C.** Geology of a quarry in the Kentland anomaly, Indiana [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 6, North-Central Sec., p. 19, 1969.

Guy, H. P. *See* Vice, R. B. 03430

03622 **Haag, Richard A.** Hobo (Pennsylvanian), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 80-83, illus., 1969.

03355 **Haas, M. W.** Frontiers in economic micropalcontology: Jour. Geol. Education, v. 17, no. 3, p. 81-86, illus., 1969.

Micropalcontology, in addition to dating and correlation, provides industry with basic data to locate depocenters, predict occurrences and trends of reservoir facies, determine shore-shelf-slope relations, pinpoint structural growth, and determine unconformities, faults, and missing stratigraphic sections. Although knowledge and applications of microfossils have greatly expanded in recent years, frontiers for research are still numerous and challenging. Understanding of many fossils is incomplete. More research is needed on faunas and their environments. Better preparation techniques and use of more powerful tools will open new vistas for analysis and understanding. Computers are accelerating the work of biostratigraphers by rapid sorting and analysis of data. Micropaleontology can and will play an increasingly important role in exploration as its applications continue to expand.—*from* Author's abstract

03112 **Haas, Otto.** Recent literature on Mesozoic ammonites, Pt. 10: Jour. Paleontology, v. 43, no. 3, p. 779-790, 1969.

More than 80 papers are reviewed in this part of the essay-review of literature on Mesozoic ammonoid cephalopods, which, like the preceding parts, is in the format of an annotated bibliography divided into four sections: General, Triassic, Jurassic, and Cretaceous. Included are proposals for three new subfamilies and at least 22 genera and 10 subgenera.—VMJ

03129 **Haas, Winfried.** Lower Devonian trilobites from central Nevada and northern Mexico: Jour. Paleontology, v. 43, no. 3, p. 641-659, illus., 1969.

The following trilobites are described from the Lower Devonian (mostly from late Helderbergian or Siegenian) of the Cortez Range and northern Simpson Park Range of central Nevada: *Decoroproetus* n.sp., *Decoroproetus*, sp., *Otarion* (*Otarion*) *periergum* n.sp., *Phacops* (*Phacops*) *claviger* n.sp., *Phacops* (Reedops) n.sp., *Odontochile* sp., *Leonaspis tuberculata favonia* n.subsp., and *Koneprusia* (n.subgen.,) *insolita* n.sp. *Synphoroides biardi* (Clarke), *Cheirurus* (,*Crotalocephalus*) sp., and *Cordania* sp. are reported from Deerparkian (late Siegenian) of Chihuahua, Mexico.—*from* Author's abstract

03398 **Hackett, James E.; McComas, Murray R.** Geology for planning in McHenry County: Illinois Geol. Survey Circ. 438, 29 p., illus., table, geol. map, 1969.

A study of the geology and natural resources of McHenry County, to provide basic data for a county plan, included: (1) detailed surficial mapping and subsurface study, correlated with soil mapping and supported by laboratory analysis; (2) evaluation of geologic units in terms of their mineral-resource, engineering, and hydrologic properties; (3) interpretative maps in which areas are graded for specific land uses; (4) analysis of terrains in units differentiated on the basis of physiography and earth materials, and evaluated in terms of their suitability for land uses. The data developed are quite adequate to establish patterns and relationships among the mineral- and hydrologic-resource factors for application to a regional plan. Individual site or local area plans require more extensive, large-scale investigations, generally involving controlled on-site drilling for subsurface data.—*from* Authors' abstract

03600 **Hackett, James E.** Water resources and the urban environment: Ground Water, v. 7, no. 2, p. 11-14, 1969.

The urbanization of the country is reflected in the emphasis on comprehensive water resources development. A major share of future water resource investigations will have to be directed to the urban environment. The general pattern associated with community development has contributed to the commodity concept of water use, where the water resource is viewed only in terms of its adequacy as a water supply; waste discharge and recreation uses are considered downstream problems. This concept is especially inappropriate in the multicommunity complexes where there is very little "downstream." Water problems must be dealt with at the metropolitan level, thinking of closed systems involving reclamation and reuse rather than the open system of withdrawal, use, and discharge.—*from* Author's abstract

03642 **Hadley, Jarvis B.** Geologic map of the Cameron quadrangle, Madison County, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-813, scale 1:62,500, section, 1969.

03588 **Hafner, Stefan S.; Virgo, David.** Cooling history of orthopyroxenes: Science, v. 165, no. 3892, p. 285-287, illus., table, 1969.

Order-disorder transitions between ferrous iron and magnesium in orthopyroxenes (minerals close to the composition $[Fe,Mg]SiO_3$) occur rapidly between approximately 480° and 1000°C. Disordering and ordering have been studied experimentally. The determination of the metastable ferrous iron site occupancy in orthopyroxenes from rapidly cooled volcanic rocks provides information on the cooling rates, especially from 600° to 480°C.—Authors' abstract

03170 **Hagland, David S.** The distribution of uranium in Recent carbonate sediments and skeletons of organisms and the effect of diagenesis on uranium redistribution [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3789B, 1969.

Hahn, Gerhard. *See* Brooks, H. K. 03492

03494 **Hahn, Gerhard.** Bostrichopodida, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R570-R572, illus., 1969.

The order Bostrichopodida Hahn, 1967 is represented by a single genus and species, *Bostrichopus antiquus* Goldfuss, 1838 from the Lower Carboniferous of Germany. The single, small specimen is here interpreted as a larval crustacean of uncertain class, either a real metanauplius of an unknown adult or a neotenic form which failed to complete transformation. Distinguishing features are the short, scarcely segmented body and the long segmented whiplike appendages(about 64 in all) radiating from the apparently biramous antennae and mandibles. Divided terminal segments of the antennules suggest possible placement among the Malacostraca.—VMJ

03068 **Hajnal, Z.** A two-layer model for the Earth's crust under Hudson Bay, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 326-336, illus., table, 1969.

An interpretation of the primary and some significant correlatable later arrival data from the east-west line of the 1965 Hudson Bay crustal seismic experiment reveals a two-layer crustal model. Two very prominent events are identified as reflection arrivals from the intermediate and the Mohorovičić discontinuities. Head waves are also observable from these interfaces. Both interfaces show significant structural relief. A general gentle decrease in depth to these discontinuities from west to east is interrupted by a significant 'high' immediately west of Gilmour Island.—Author's abstract

03069 **Hall, Donald H.** A seismic-isostatic analysis of crustal data from Hudson Bay, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 337-364, illus., tables, 1969.

Methods of comparing crustal seismic sections isostatically without reference to gravity data were applied to interpretations made for the east-west line (lat 60° N.) of the 1965 crustal seismic experiment, and to crustal seismic results in areas surrounding Hudson Bay. It was found that: (1) depth of compensation is probably near 60 km; (2) the crustal section along lat 60° N. exhibits a block structure; (3) the blocks may not all be in mutual isostatic equilibrium; (4) the west and central portion of the Bay is in isostatic equilibrium with the Precambrian Shield area to the south and west of the Bay; (5) the extreme western portion of the Bay north of lat 58° N. is isostatically "light" as is a narrow crustal block running north-south at long 86° W.; (6) a crustal block about 200 km wide, running southwest from Mansel Island, is isostatically "heavy".—*from* Author's abstract

02994 **Hall, John W.** A reappraisal of the megaspores of two Eocene species of *Azolla*: Jour. Paleontology, v. 43, no. 2, p. 528-531, illus., 1969.

Megaspores of the heterosporous water fern, *Azolla*, have a swimming apparatus consisting of floats attached to a distal, peglike columella; the number of floats is an important taxonomic character. Reexamination of material of the Eocene species, *Azolla primaeva* (Penhallow) Arnold, from British Columbia, shows that true floats are not present, and the swimming apparatus consists only of a columellate float. *A. intertrappea* Sahni and Rao, also Eocene, from India, has been confirmed as the oldest species of *Azolla* whose megaspores possess three floats.—SHM

03059 **Hamblin, W. K.** Late Cenozoic lava flows in the Grand Canyon of the Colorado River, Arizona, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 41-60, illus., 1969.

The area of most intense late Cenozoic volcanism in the Grand Canyon lies on the north rim between Toroweap Valley and Whitmore Wash at the south end of the Uinkaret Plateau. A tentative classification recognizes four groups of flows: (1) older intracanyon flows, (2) younger intracanyon flows, (3) valley fill, and (4) lava cascades. Older intracanyon basalt flows occur in isolated remnants between Toroweap Valley and Whitmore Wash. Younger intracanyon flows can be traced downstream far beyond the cascades of Toroweap Valley and Whitmore Wash. Basalt flows filled several tributary valleys. The largest of these are Prospect Canyon, Toroweap Valley and Whitmore Wash. The youngest flows within the Grand Canyon have cascaded over the rim of the Esplanade into the inner gorge.—KAF

03631 **Hamilton, Dean C.** Rough Draw (Noodle Creek), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 114-117, illus., 1969.

03549 **Hamilton, Warren.** Reconnaissance geologic map of the Riggins quadrangle, west-central Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I-579, scale 1:125,000, 1969.

03645 **Hardy, David G.** Azalea (Grayburg, Strawn, Devonian), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 9-21, illus., 1969.

Harper, C. W. *See* Walmsley, V. G. 02960

Harrison, C. G. A. *See* Ball, M. M. 03301

03029 **Harrison, Samuel Sterrett.** The effects of groundwater seepage on stream regimen—A laboratory study [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4226B, 1969.

Harrison, William. *See* O'Brien, Neal R. 03584

03394 **Hassemer, Jerry.** A conglomerate cave in Oak Creek Canyon, Arizona: Plateau, v. 41, no. 4, p. 178-183, illus., 1969.

Grandad Cave, in an unnamed side canyon a mile north of Call-of-the-Canyon resort, is small but uniquely formed in conglomerate, whereas almost all other caves are in limestone, gypsum, or as lava tubes in basalt. In this area, the Cenozoic gravels forming the conglomerate, now up to 160 feet thick, were deposited by north-flowing streams on an erosion surface of the Kaibab Limestone. Faulting, before and after eruption of the capping Pliocene lava, displaced contacts and provided numerous routes for surface water to enter and dissolve calcite from limestone pebbles in the conglomerate as well as the $CaCO_3$ cement. Speleothems are concentrated along many faults; the cave stream bed is floored with conglomerate pebbles and with subrounded basalt rocks probably from the cap rock.—GDC

03102 **Hatten, Charles W.** Noel K. Brown, Jr. (1925-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1522-1523, portrait, 1969.

03533 **Hattin, Donald E.** Reference section for Lincoln Limestone Member, Greenhorn Limestone (Upper Cretaceous), Lincoln County, Kansas, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 29-33, illus., 1969.

The lowest part of the Greenhorn Limestone received a geographic name more than a quarter of a century before the remaining part of the unit was formally subdivided. First referred to as the "Lincoln Marble" (Logan, 1897), the unit was later renamed "Lincoln Limestone Member" by Rubey and Bass (1925). Because no type section for the Lincoln Limestone Member was designated by early workers, the author has designated as a reference section the exposure in SE SE sec. 31, T 12 S, R 10 W, Lincoln County, Kansas. The stratigraphic section is described and illustrated.—Author's abstract

Hauf, Charles B. *See* Vandersluis, George D. 03007

03607 **Haun, John D.** Why teach petroleum geology?: Mines Mag., v. 59, no. 5, p. 5, 1969.
Approximately 40 percent of all earth scientists in the United States and Canada are employed as petroleum geologists, yet only 27 percent of the universities provide courses in this speciality. There is a need for more petroleum geology courses to prepare students for this field.—KAF

03098 **Hauptman, J. R., Jr.** Guy Joseph Scholl (1900-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1525-1526, portrait, 1969.

03576 **Hawley, C. C.** Geology and beryllium deposits of the Lake George (or Badger Flats) beryllium area, Park and Jefferson Counties, Colorado: U.S. Geol. Survey Prof. Paper 608-A, p. A1-A44, illus., tables, geol. maps, 1969.

The Lake George beryllium area is underlain principally by Precambrian rocks. The oldest rock unit, the Idaho Springs Formation, was extensively invaded by granitic bodies. The Boulder Creek(?) Granodiorite was emplaced at about the time of plastic deformation of the Idaho Springs Formation; the Pikes Peak Granite was emplaced about 700 m.y. later. The principal ore deposits are beryllium-bearing veins, pipes, and irregular bodies enveloped by greisenized granite. They consist of beryl or bertrandite and subordinately of arsenopyrite, wolframite, molybdenite, galena, sphalerite, and rarer metallic minerals, and the greisen minerals muscovite, topaz, fluorite, and quartz. The deposits are spatially and genetically related to the Redskin Granite; the main deposit at the Boomer mine is a good example of cupola-type mineralization.—CCH

03138 **Hay, John.** Salinity and Hudspeth County, Texas [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 3, 1969.

Hayden, Sandi. *See* McKelvey, V. E. 03513

03127 **Hazel, Joseph E.; Valentine, Page C.** Three new ostracodes from off northeast North America: Jour. Paleontology, v. 43, no. 3, p. 741-752, illus., 1969.

Three new species of cytheraccan ostracodes—*Cytherura, mainensis* (Holocene and Pleistocene), *Munseyella atlantica* (Holocene), and *M. mananensis* (Holocene and Pleistocene)—and their distributions [Baffin Bay to Virginia] are described. *Munseyella* is reported from the Holocene off northeastern North America for the first time, and its soft parts are described and illustrated, also for the first time.—Authors' abstract

Hedberg, Hollis D. *See* National Petroleum Council. 03526

03466 **Henderson, Edward P.; Hooker, Marjorie.** Memorial of Frank L. Hess—September 4, 1871-August 29, 1955: Am. Mineralogist, v. 54, nos. 3-4, p. 626-634, portrait, 1969.

03171 **Herber, Lawrence J.** Order-disorder in coexisting plagioclase and alkali feldspar from the Mineral Range of southwest Utah [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3789B-3790B, 1969.

03342 **Herzenberg, C. L.; Lamoreaux, R. D.; Riley, D. L.** Mössbauer resonant absorption in ferberite and wolframite [with German abs.]: Zeitschr. Kristallographic, v. 128, nos. 3-6, p. 414-417, illus., table, 1969.

Mössbauer hyperfine absorption spectra have been measured for the iron tungstate minerals, wolframite and ferberite. Characteristic spectra with moderately large electric quadrupole splittings and isomer shifts typical of high-spin ferrous iron are observed.—Authors' abstract

Hessler, R. R. *See* Brooks, H. K. 03492

03386 **Hessler, Robert R.** Cephalocarida, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R120-R128, illus., 1969.

Cephalocarida Sanders, 1955, here limited to two families and two extant genera, *Hutchinsoniella* and *Lightiella*, are a class of benthonic marine crustaceans inhabiting intertidal and subtidal zones. Cephalocarids are the most primitive known crustaceans as judged by their generalized morphology and high degree of serial homology, and probably are close to the protocrustacean stock; it is possible to derive the limbs and muscle patterns of all classes of crustaceans from the cephalocarid types. *Tesnusocaris goldrichi* Brooks, from the Pennsylvanian of Texas, should be rejected from the Cephalocarida because the maxillae and thoracic limbs are entirely different (in the Treatise, it is placed in Malacostraca, by H. K. Brooks and others, V. 2, p. R552, 1969).—VMJ

03388 **Hessler, Robert R.** Mystacocarida, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R192-R195, illus., 1969.

The class Mystacocarida Pennak and Zinn, 1943 lacks a fossil record. Two wide-ranging infaunal species of one genus, *Derocheilocaris*, inhabits intertidal beaches. Mystacocarids are very minute crustaceans with elongate body divided into: cephalon, maxilliped segment, and thoraco-abdomen bearing much reduced thoracic limbs. Although similarity of tagmosis and cephalic limbs suggests relation to the Copepoda, mystacocarids are clearly more primitive than copepods, also resembling Cephalocarida and larval Branchiopoda; the unreduced mandible is even more primitive than that of cephalocarids and the somite bearing the maxillipeds is free and only now in the process of cephalization.—VMJ

03490 **Hessler, Robert R.** Branchiura, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R203-R206, illus., 1969.

The class Branchiura Thorell, 1864, as here restricted, comprises a single order and family (Argulidae) containing four extant genera and no fossil forms. These small, highly specialized crustaceans are free-swimming ectoparasites on fishes in both fresh and salt water. The dorsoventrally flattened body is divided into cephalon, thorax, and very small abdomen. The cephalon, with backward projecting cephalic shield, carries the usual five pairs of cephalic limbs; the two pairs of antennae are fitted with hooks, the maxillules are modified as stalked sucking discs, and the mouth is a piercing proboscis. Branchiurans were long classed under Copepoda, but the tagmoses are basically different. The Carboniferous family Cyclidae Packard, 1885, placed under Cycloidea (Glaessner, ibid., V. 2, p. R567-R570), resemble branchiurans superficially but are considered unrelated.—VMJ

03437 **Heusser, Calvin J.** Modern pollen spectra from the Olympic Peninsula, Washington: Torrey Bot. Club Bull., v. 96, no. 4, p. 407-417, illus., 1969.

Surface samples from 52 sites located in different sectors and altitudinal ones between sea level forest and alpine tundra were collected and analyzed for pollen and spores. Resulting spectra are dominated by western hemlock (*Tsuga heterophylla*) and red alder (*Alnus rubra*), and spectral prominences are generally consistent with zones where the pollen originates. Extra-zonal pollen, however, makes up a part of the rain in each of the zones. Spectral variation within a zone results from degrees of disturbance caused largely by fire, logging, and clearing and from local over-representation by site-restricted species. For interpretations of north Pacific Pleistocene pollen profiles, modern spectra from both latitudinally distributed coastal sites and altitudinal localities in mountainous areas, such as is represented by the Olympic Peninsula, are of considerable worth.—Author's abstract

Hiler, Edward A. *See* Rahman, Md. Ataur. 03330

Hinyard, Paul. *See* McCallum, Henry D. 03099

03530 **Hladik, William B.; Bauleke, Maynard P.** Low-density ceramic bodies from clay and expanded volcanic ash from Kansas, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 19-20, tables, 1969.

Ceramic bodies with densities ranging from 14.5 to 28.8 lbs/cu ft and compressive strengths ranging from 84 to 232 psi were prepared from clay-expanded volcanic ash mixtures. Bodies were not watertight, but they can be used in nonload-bearing construction applications.—Authors' abstract

Hobson, G. D. *See* Hood, Peter J. 02963

03313 **Hobson, G. D.; Hunter, J. A.** In-situ determination of elastic constants in overburden using a hammer seismograph: Geoexploration, v. 7, no. 2, p. 107-111, illus., 1969.

Shear-wave energy can be recorded on a portable hammer seismograph and this energy complemented by compressional-wave data permits a determination of Poisson's ratio and other elastic constants for overburden in-situ. There are direct applications to engineering projects. The majority of values for Poisson's ratio obtained by this in-situ method are considerably higher than those observed in consolidated rock.—Authors' abstract

02974 **Hobson, George D.** Seismic refraction results from the Hudson Bay region, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 227-246, illus., 1969.

Results of onshore and offshore seismic refraction surveys in the Hudson Bay Lowlands area in 1963, 1964, and 1965 are presented as seismic cross-sections to permit closer correlation with results of the 1967 Operation Winisk. The geological map from Operation Winisk does not show the Precambrian topographic high deduced from seismic data in the region of the Winisk River. The only way this can be reconciled is to grant that the Ordovician and Silurian formations are too thin to transmit seismic energy or that high velocities assumed to represent Precambrian rocks actually should be identified as the Ordovician and Silurian carbonates. There appears to be considerable structure within the Hudson Bay sedimentary basin. Lower and intermediate values of seismic velocities indicate the probable presence of Mesozoic sediments overlying the Paleozoic section.—KAF

03315 **Hobson, George D.** Hammer refraction seismic survey to assist biogeochemical program Lucky Ship, British Columbia, App. D *in* Biogeochemical prospecting for molybdenum in west-central British Columbia: Canada Geol. Survey Paper 68-56, p. 30-41, illus., table, 1969.

Thickness of overburden in the area varies from 0 to about 50 feet; average is less than 15 feet and consists of a humus layer overlying a mixture of unconsolidated glacial material and talus. Bedrock surface is identified with a seismic velocity in excess of 9,300 feet per sec; mineralization occurs in a zone concentric about a granitic plug. Velocities less than 14,500 feet per sec have been correlated with quartz porphyry and greater velocities with Middle Jurassic country rock. A few anomalously low velocities are probably due to fine fracturing in quartz porphyry. Extremely good velocity contrasts between overburden and bedrock permit accurate determination of overburden thickness. Contrast in rate of transmissions of seismic energy through quartz porphyry and surrounding Jurassic sediments and volcanics permits the contact between these formations to be established fairly accurately.—MCM

03495 **Hoffman, Richard L.** Myriapoda, exclusive of Insecta, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R572-R606, illus., 1969.

Hoffman here defines the superclass Myriapoda Latreille, 1796 as "mandibulate terrestrial arthropods with body divided into head and trunk, the latter showing all gradations from series of similar metameres to distinction into trisegmented thorax and multisegmented abdomen. . ." and uses a classification different from that used elsewhere in the Treatise; he places Crustacea and Myriapoda as superclasses under the subphylum Mandibulata (a term which Manton, ibid., V. 1, flatly rejects), and places Insecta as a class under Myriapoda. The myriapod classes treated here are: Archipolypoda (Paleozoic); Diplopoda and Chilopoda, well represented by fossil and living forms; Symphyla and Pauropoda, with few or no fossil forms.—VMJ

03316 **Hofmann, H. J.** Stromatolites from the Proterozoic Animikie and Sibley Groups, Ontario: Canada Geol. Survey Paper 68-69, 77 p., illus., table, 1969.

The Animikie forms are present in two chert horizons in the Gunflint and Biwabik Formations. They comprise lamellar, columnar-laminar, columnar, nodular, and oncolitic forms, grouped in seven arbitrary categories. They exhibit more or less consistent variations from one of them (form A) in shape, size, spacing, linkage, overall attitude, and inheritance of laminae. They have characteristics attributable to eight groups with which they are compared but not identified. Three types of microstructures, simple distinct, simple diffuse, and pillared are also present, and are derived

predominantly from stromatolites with simple diffuse microstructure. The Sibley stromatolites, from dolomite beds 90 m above the base of the unit, are *Conophyton* cf. of *C. garganicus*Korolyuk (emend.). Their Helikian age is in agreement with the stratigraphic scheme for the Riphean conophytons.—*from* Author's abstract

Holm, Richard W. *See* Ehrlich, Paul R. 03534

03461 **Holser, William T.** Memorial of James Dabney Burfoot, Jr.—October 18, 1896-February 27, 1966: Am. Mineralogist, v. 54, nos. 3-4, p. 598-600, portrait, 1969.

Holthuis, L. B. *See* Brooks, H. K. 03492

03075 **Hood, Peter; Bower, Margaret; Godby, E. A.** Magnetic surveys in Hudson Bay—1965 Oceanographic Project, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 272-291, illus., 1969.

A low-level Decca-controlled high-resolution aeromagnetic survey of a portion of central Hudson Bay was carried out in 1965. Most of the small amplitude anomalies were repeatable and some extend for many miles in directions which are quite different from the main anomalies. Depth-to-basement determinations carried out on the main anomalies consistently give values in excess of 8,000 feet. The 200-gamma generalized total intensity map shows that the northeast-striking Owl River magnetic high continues into Hudson Bay and bends in a southerly direction to become first east-, then southeasterly-striking. There is some indication that a branch may continue northeastwards in the general direction of Cape Smith. Sea magnetometer data does indicate, however, that the Cape Smith-Wakeham Bay belt of basic rocks extends into Ottawa Islands.—*from* Authors' abstract

02963 **Hood, Peter J.; Hobson, G. D.; Norris, A. W.; Pelletier, B. R.** (editors). Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, 385 p., illus., tables, 1969.

This volume contains papers presented at the Earth Science Symposium on Hudson Bay, held in Ottawa on February 19-20, 1968, sponsored by the National Advisory Committee on Research in the Geological Sciences and the Associate Committee on Geodesy and Geophysics of the National Research Council. Results of the 1965 Hudson Bay Oceanographic Project are presented along with papers on the geology of the Hudson Bay Lowlands resulting from the 1967 Operation Winisk.—KAF

03544 **Hooke, Roger LeB.** Crystal shape in polar glaciers and the philosophy of ice-fabric diagrams [discussion of "The complexities of the three-dimensional shape of individual crystals in glacier ice," by G. P. Rigsby, 1968]: Jour. Glaciology, v. 8, no. 53, p. 324-326, illus., 1969.

Rigsby (ibid., v. 7, no. 50, p. 233-251) suggests that complexity of coarse ice crystals may cast doubt on fabric diagrams of temperate glacier ice, without knowing whether finer-grained polar ice crystals are as complex. In serial thin sections, separated crystals with c-axes nearly parallel could be cells of one crystal; for fabric diagrams, a bent crystal or rotated broken parts might count as two or more. Crystals in a core taken beneath ablation till near Thule, Greenland, were traced and diagram points approximately weighted according to area of cells exposed. Only four of 20 crystals selected could be traced for 1 cm; none seemed long or intertwined as were Rigsby's larger crystals. Knowledge of texture facilitates interpretation of published fabric diagrams accepted at par value.—GDC

Hooker, Marjorie. *See* Henderson, Edward P. 03466

03172 **Hoover, Richard Alan.** Physiography and surface sediment facies of a Recent tidal delta, Harbor Island, central Texas coast [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3790B, 1969.

03553 **Hopkins, Marie L.; Bonnichsen, Robson; Fortsch, David.** The stratigraphic position and faunal associates of *Bison* (*Gigantobison*) *latifrons* in southeastern Idaho—A progress report: Tebiwa, v. 12, no. 1, p. 1-8, illus., 1969.

The vertical range of *Bison latifrons* in the Pleistocene deposits of the American Falls Lake is up to 30 feet, but may be as much as 40. Five genera associated with this species from Kansas were recognized among a total of 17 mammal and 2 bird genera. An associated musk ox is reported for the first time from Idaho. Sedimentary data suggest an emplacement of the bison by currents generally stronger than usually found in lakes, and in a direction toward the west, possibly from the overflow of Lake Bonneville into the Snake River area.—HRC

Horn, B. M. *See* Horn, D. R. 03484

03484 **Horn, D. R.; Delach, M. N.; Horn, B. M.** Distribution of volcanic ash layers and turbidites in the North Pacific: Geol. Soc. America Bull., v. 80, no. 9, p. 1715-1723, illus., table, 1969.

Ash occurs within a broad zone 600 to 800 miles wide seaward of the island arcs and continental land areas that constitute the margins of the North Pacific Basin. Active volcanoes at the periphery of the basin provide an adequate source. Turbidite deposition is restricted to the sea floor off the western coast of North America, axial portions of the circum-Pacific trench system, and around the Hawaiian Ridge. Sediment dispersal is directly related to the availability of large amounts of terrigenous material and the absence of regional traps and barriers to basinward movement of coarse sediment. No turbidites occur in cores from much of the Aleutian and Alaskan Abyssal Plains, and the western and northern parts of the Tufts Abyssal Plain. The cores contain pelagic deposits and support the view that these plains are products of earlier sedimentary regimes.—*from* Authors' abstract

Hornbaker, Allison L. *See* Bauleke, Maynard P. 03528

03146 **Hornbrook, E. H. W.** Biogeochemical prospecting for molybdenum in west-central British Columbia: Canada Geol. Survey Paper 68-56, p. 1-29, illus., tables, 1969.

A biogeochemical prospecting program was conducted to determine distribution of molybdenum and associated elements in plant organs and soils and to evaluate effectiveness of plant prospecting techniques. New and modified methods for collection and preparation of samples, and spectrographic analysis of organic material were used simultaneously. Materials collected from the 144-station grid included B and A_0 horizons, bark, and second year twig and needle. Alpine fir was sampled at all stations and lodgepole pine at 60. Shallow seismic determinations of depth and nature of surficial material were made. Organic samples were analyzed spectrographically for Ba, Sr, Mn, Ti, Ag, Cr, and Co; soil and vegetation samples colorimetrically for Mo, Cu, Zn, Pb, and Ni. Results indicate several advantages over soil analysis.—*from* Author's abstract

02986 **Howe, Herbert J.** Lighting techniques in photomacrography: Jour. Paleontology, v. 43, no. 2, p. 589-590, illus., 1969.

The use of a single light source with a reflector and a diffuser provides an adequate main light and fill-in for many subjects, such as the deeply concave interior surfaces of shells and strongly ornamented surfaces.—RCD

03085 **Hsü, K. Jinghwa; Ohrbom, Richard.** Mélanges of San Francisco Peninsula—Geologic reinterpretation of type Franciscan: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1348-1367, illus., table, 1969.

The "type Franciscan" at San Francisco Peninsula includes graywacke, shale, conglomerate, limestone, volcanic rock, radiolarian chert, serpentinite, and glaucophane schist. The various types of rocks are present mainly as tectonic inclusions, ranging from fragments a few inches in diameter to allochthonous slabs several miles long, in a pervasively shaly matrix. This mixture constitutes an assemblage of mélanges. Franciscan rocks were derived from the fragmentation and mixing of two stratigraphic units—a pre-Tithonian San Francisco unit (new) of eugeosynclinal rocks, and a Tithonian to Upper Cretaceous San Mateo unit (new) that is a western extension of the Great Valley sequence. Different associations of tectonic inclusions within the Franciscan mélanges were differentiated.—*from* Authors' abstract

03189 **Hubbard, John Edward.** Cesium-137 in an alpine watershed [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3814B, 1969.

03376 **Hudspeth, Robert.** Shorelines and deltas—Coastal studies of the Gulf of California and the Colorado River delta, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. G20-G22, illus. [1969?].

Two periods of emergence separated by a great submergence occurred in this area in the Quaternary. The Bellenas fault marks the terminus of the steep eastern gradient of the peninsula. The eastern coastline is marked by a marsh composed of three zones of erosion.—ESL

03457 **Huebner, J. Stephen.** Stability relations of rhodochrosite in the system manganese-carbon-oxygen: Am. Mineralogist, v. 54, nos. 3-4, p. 457-481, illus., tables, 1969.

The common occurrence of rhodochrosite with hausmannite, and its rare equilibrium association with manganosite, bixbyite, and pyrolusite are natural expressions of O_2 and CO_2 fugacity and temperature dependence of the rhodochrosite stability field. Relations of those bounding-reaction variables which produce manganese oxides and graphite were determined. Equations are given for the rhodochrosite-manganosite-gas equilibrium surface, determined on graphite, Ni-NiO, and manganosite-hausmannite buffers at 1000, 1500, and 2000 atm and on manganosite-hausmannite and hausmannite-bixbyite buffers. Rhodochrosite is stable at high temperatures only at low O_2 fugacity. Comparison of stability fields suggests that addition of manganese expands the siderite field, reduces calcite, and causes little change in magnesite. Oxygen fugacities in the Mn-C-O system are higher than in corresponding iron-bearing systems.—ESL

Huh, John M. *See* Baulcke, Maynard P. 03529

03173 **Huh, Oscar Karl.** Mississippian stratigraphy and sedimentology, across the Wasatch line, east-central Idaho and extreme southwestern Montana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3790B-3791B, 1969.

03595 **Hungerford, James J.** Lacustrine sediments of a drained lake in northwest Iowa, Pt. 1: Iowa State Jour Sci., v. 43, no. 3, p. 253-260, illus., tables, 1969.

Chemical analyses of inorganic carbonate and organic matter percentages and macroscopic observations of sediments from Pillsbury Lake in northwestern Iowa are presented. The sediment includes depositions which began in late Wisconsin time; paleoecological interpretations and fossil mollusk identifications are presented.—Author's abstract

03329 **Hunt, Charles B.** John Wesley Powell, his influence on geology: Geotimes, v. 14, no. 5, p. 16-18, illus., 1969.

Hunt, J. M. *See* Deuser, W. G. 03305

Hunter, J. A. *See* Hobson, G. D. 03313

Hurley, R. J. *See* Ball, M. M. 03301

03548 **Hutchison, Harold C.** (compiler). Map of southwestern Indiana showing locations of active coal mines: Indiana Geol. Survey Misc. Map 7, scale about 1 in. to 6 mi., revised 1969; originally published 1962.

Hyden, Harold J. *See* Fraser, George D. 03391

03419 **Ibrahim, Abou-Bakr.** Determination of crustal thickness from spectral behavior of SH waves: Seismol. Soc. America Bull., v. 59, no. 3, p. 1247-1258, illus., tables, 1969.

The amplitude spectrum obtained from Haskell's matrix formulation for body waves traveling through a horizontally layered crustal model shows a sequence of minima and maxima. It is known that multiple reflections within the crustal layers produce constructive and destructive interferences, which are shown as maxima and minima in the amplitude spectrum. Analysis of the minima in the amplitude spectra, which correspond to zero phase in the phase spectra, enables us to determine the thickness of the crust, provided the ratio of wave velocity in the crust to velocity under the Moho is known.—Author's abstract

03186 **Ikawa, Haruyoshi.** The weathering of Hawaiian volcanic glass and the transformation of amorphous and crystalline phases [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3852B, 1969.

03609 **Innes, D. G.** (compiler). Wababimiga-Jog Lakes sheet, District of Cochrane: Ontario Dept. Mines Prelim. Geol. Map P. 549, scale 1 in. to 2 mi., text, 1969.

03610 **Innes, D. G.** (compiler). Mammamattawa sheet, District of Cochrane: Ontario Dept. Mines Prelim. Geol. Map P. 550, scale 1 in. to 2 mi., text, 1969.

03611 **Innes, D. G.** (compiler). Caramat sheet, Districts of Cochrane, Thunder Bay and Algoma: Ontario Dept. Mines Prelim. Geol. Map P. 551, scale 1 in. to 2 mi., text, 1969.

03612 **Innes, D. G.** (compiler). Pagwa River-Calstock sheet, Districts of Cochrane and Algoma: Ontario Dept. Mines Prelim. Geol. Map P. 552, scale 1 in. to 2 mi., text, 1969.

03312 **Ives, Jack D.** Institute of Arctic and Alpine Research: Arctic, v. 22, no. 2, p. 87-89, 1969.

INSTAAR is an inter-disciplinary research and teaching organization within the Graduate School of the University of Colorado. In 1967 the University went ahead with the first phase of expansion and development of the Institute, founded in 1951. Research activities, publications, and objectives are discussed.—ESL

03337 **Ives, Jack D.; Buckley, Jane T.** Glacial geomorphology of Remote Peninsula, Baffin Island, N.W.T., Canada: Arctic and Alpine Research, v. 1, no. 2, p. 83-95, illus., 1969.

The physiography of this peninsula is described as a basis for interpretation of glacial geomorphology. Two moraine systems are recognized—one predating the Wisconsin Stage, and the younger associated with existing glaciers. Carbon-14 dates on mollusk shells from deltas between members of older moraines give an estimate of 36,000 yr B.P. It is concluded that large areas of uplands remained ice free during the Wisconsin. Support for this is derived from construction of two trend-surface analysis maps using spot heights on two members of the older moraine system. An examination of gradients of 200 extant glaciers also provides evidence. Geomorphic investigations of upland areas point to an absence of glacial forms. Weathering on the uplands also indicates a considerably longer time lapse than is available since culmination of the Wisconsin.—*from* Authors' abstract

03514 **Jackson, C. Ian.** What price frozen wealth,: New Scientist, v. 41, no. 640, p. 572-573, 1969.

Major discoveries of oil in northern Alaska may raise hopes of arctic development, but technology works against it in use of more new equipment and fewer working people, with outside direction to frustrate local initiative, and perhaps relevance to marginal resources far from the Arctic. It has been pointed out that the North offers few resources that are not available more cheaply elsewhere. The iron in Labrador-Ungava is an exception in which half a century was required for feasible exploitation. Not only were lenses of permafrost a problem, but the interprovincial boundary, defined as the watershed, could be shifted considerably by mining operations. As at Great Slave Lake and other northern areas of Canada, railroad haul adds to costs. A large amount of available hydro power in Canada is undeveloped for lack of a market for electricity.—GDC

03396 **Jacobs, Alan M.; Lineback, Jerry A.** Glacial geology of the Vandalia, Illinois, region: Illinois Geol. Survey Circ. 442, 23 p., illus., tables, 1969.

Around Vandalia, deposits and soils of Kansan, Yarmouthian, Illinoian, Sangamonian, and Wisconsinan Stages rest on Pennsylvanian bedrock. Units are compared in grain size, clay mineralogy, and carbonate composition. Kansan till, with truncated Yarmouth Soil, is exposed at a few places. Smithboro till contains most of the expandable clay minerals; lenses of Mulberry Grove silt separate it from overlying Vandalia till. Above this are the Hagarstown beds with well-sorted gravels in serpentine ridges marking meltwater channels in the glacier that deposited Vandalia till, and outwash, ablation deposits, and mass-movement materials from the ice surface. Sangamon Soil formed on Hagarstown beds or on Vandalia till. Above accretion-gleys, lacustrine and swamp sediments (Sangamonian and Wisconsinan) are Roxana Silt and Peoria Loess, with Wisconsinan valley train along major streams.—GDC

Jambor, J. L. *See* Steacy, H. R. 03318

03478 **Jambor, J. L.** Coalingite from the Muskox intrusion, Northwest Territories: Am. Mineralogist, v. 54, nos. 3-4, p. 437-447, illus., tables, 1969.

Coalingite, a hydrous Mg-Fe^{3+} oxide, discovered in 1965 in the New Idria serpentinite, California, occurs as fracture fillings in drill cores from the Muskox Intrusion, Northwest Territories. The Muskox coalingite contains more iron and significantly less carbon dioxide than the type material. The mineral is trigonal, with $a = 3.1$ A, c uncertain. Muskox coalingite is believed to have formed *in situ* at room temperature during storage of the drill cores.—Author's abstract

James, Alan T. *See* Fraser, Gordon S. 03656

03021 **James, Clarence Hubert.** Optimum preload rates for compressible normally consolidated soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4158B, 1969.

03393 **James, David E.; Sacks, I. Selwyn; Lazo L., Eduardo; Aparicio G., Pablo.** On locating local earthquakes using small networks: Seismol. Soc. America Bull., v. 59, no. 3, p. 1201-1212, illus., 1969.

Mathematical instability in four-parameter least squares hypocenter solutions arises from the fact that the four computed variables—origin time (T_o), focal depth (h), latitude (ϕ), and longitude (λ)—are strictly independent; T_o exhibits a nonindependent relation with the geometric parameters. For small networks, lack of independence between T_o and other variables results in unstable least-squares solutions. This instability is manifested clearly by the fact that different station subsets of the observational network produce significantly different solutions for the same earthquake. A formula is given for eliminating instability by computing T_o independently for each station. Dimensions and geometric configuration of the network in relation to the epicenter and proximity of the epicenter to any station are controlling factors in predicting the minimum uncertainty for a hypocenter solution.—*from* Authors' abstract

03030 **James, William R.** Development and application of nonlinear regression models in geology [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4226B, 1969.

03614 **Jeary, Gene L.** Cope, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 32-35, illus., 1969.

03174 **Jenney, William Willis, Jr.** The structure of a portion of the southern California batholith, western Riverside County, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3791B, 1969.

Joensuu, Olva. *See* Bonattti, Enrico. 03451

03031 **Johnson, Eben Lennart.** Precambrian geology of parts of Passaic County and Sussex County, New Jersey, and infrared absorption studies of biotite [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4227B, 1969.

03104 **Johnson, J. G.** Origin of *Gruenewaldtia* (Devonian, Brachiopoda): Jour. Paleontology, v. 43, no. 4, p. 947-951, illus., 1969.

Consideration of factors of internal and external morphology, stratigraphic range, and paleogeographic distribution indicate that the ancestor of *Gruenewaldtia* was one of the vagraniid atrypids, *Vagrania* or *Toquimaella* [Siegenian-Eifelian, Asia, western and Arctic North America] of the subfamily Karpinskiinae. *Gruenewaldtia* [Eifelian-Givetian, Europe and Asia] is regarded as a specialized end-member of its lineage which became extinct without giving rise to any new generic taxa.—Author's abstract

03128 **Johnson, J. G.** Some North American rensselandiid brachiopods: Jour. Paleontology, v. 43, no. 3, p. 829-837, illus., 1969.

A new species, *Subrensselandia nolani* from the middle Givetian (upper Middle Devonian) of Nevada, is described and illustrated. The type species of *Subrensselandia, S. claypolii* (Hall) is re-illustrated and its internal morphology is re-evaluated. *Rensselandia laevis* (Meek) from the Mackenzie River basin of western Canada, was studied by means of serial sections and by preparation of internal molds. Considering the value of crural plates, generic assignment of *R. laevis* is confirmed for the first time, but the species proves to bear cardinal process lobes, previously unknown in the genus or in Rensselandiinae. In North America, *Subrensselandia* occurs from lower to middle Givetian and *Rensselandia* probably ranges throughout the Givetian Stage.—*from* Author's abstract

03284 **Johnson, J. G.; Murphy, M. A.** Age and position of Lower Devonian graptolite zones relative to the Appalachian Standard Succession: Geol. Soc. America Bull., v. 80, no. 7, p. 1275-1282, illus., 1969.

Although Lower Devonian monograptid faunas of North America cannot be correlated with the Old World fauna, it is now possible to correlate graptolite zones in eastern with those in western North America. Three central Nevada graptolite zones interbedded with shelly and conodont-bearing carbonate rocks coupled with an auxiliary succession at Royal Creek, Yukon Territory, Canada can be correlated with the Appalachian Lower Devonian standard on the basis of brachiopods and conodonts. The *Monograptus uniformis* Zone correlates with the Coeymans Limestone, the *M. praehercynicus* Zone with the New Scotland Formation, and the *M. hercynicus* Zone with the Becraft Limestone. The position of the *Monograptus yukonensis* Zone corresponds to the Oriskany-Esopus interval.—*from* Authors' abstract

02973 **Johnson, Ronald D.; Nelson, Samuel J.** Sogepet-Aquitaine Kaskattama Province No. 1 well, Hudson Bay Lowland, Manitoba, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 215-226, illus., 1969.

The Sogepet-Aquitaine Kaskattama Province No. 1 well, on the west shore of Hudson Bay at lat 57°14′ N. and long 90°10′ W., was drilled to a depth of 2,491 feet. A seismic refraction profile at the wellsite shows velocities of 10,500, 13,000, 18,200, and 20,000 feet per sec with interfaces near the base of the Middle Devonian, near the top of the Middle Silurian, and near the top of the Upper Ordovician. No refractor was found at the Phanerozoic-Precambrian contact. A velocity survey shows interval velocities of 10,300 to 13,600 feet per sec for the Middle Devonian with velocities as low as 9,500 feet per sec in the Upper Silurian increasing to averages of 16,500 feet per sec in the Middle Silurian and 22,500 feet per sec in the Upper Ordovician.—*from* Authors' abstract

03032 **Jones, Billy Ray.** Geology of southern Quitman Mountains and vicinity, Hudspeth County, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4227B, 1969.

03155 **Jones, D. L.; MacKevett, E. M., Jr.** Summary of Cretaceous stratigraphy in part of the McCarthy quadrangle, Alaska: U.S. Geol. Survey Bull. 1274-K, p. K1-K19, illus., 1969.

Cretaceous sedimentary rocks in the central part of the McCarthy 1-degree quadrangle constitute a complex stratigraphic sequence divided into the Kennicott,

Moonshine Creek, Schulze, Chititu, and MacColl Ridge Formations. The Kennicott is redefined to include only lowermost rocks, a lower sandstone and an upper siltstone member are recognized; the other formations are newly named. The rocks were deposited in shallow seas, reflect several marine transgressions and regressions, have a cumulative thickness of almost 13,000 feet, are separated from underlying rocks by an angular unconformity and from overlying rocks by a slight angular discordance, and are cut by felsic dikes and sills and intruded in several places by plutonic rocks. Because they are locally fossiliferous, well exposed, and only slightly deformed, they are an important biostratigraphic reference section for early Albian to late Campanian strata.—*from* Authors' abstract

03175 **Jones, Neil Owen.** The development of piping erosion [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3791B, 1969.

03475 **Jones, Norris W.; Ribbe, P. H.; Gibbs, G. V.** Crystal chemistry of the humite minerals: Am. Mineralogist, v. 54, nos. 3-4, p. 391-411, illus., tables, 1969.

Fifty-five humite minerals were analyzed by microprobe X-ray emission for F, Mg, Si, Ca, Ti, Mn, Fe, and Zn. The microprobe analyses indicated that the humite minerals are stoichiometric, in contrast to chemical analyses, which showed them nonstoichiometric. Single crystal X-ray studies of eight microprobe-analyzed humites show that the substitution of (Fe + Mn) for Mg increases the normalized cell volume; that Ti + 2(O) for Mg + 2 (OH,F) has little effect on the cell volume; and that (OH,F) + tetrahedral vacancies for O + Si results in a decrease in cell volume. No polytypism was observed.—*from* Authors' abstract

03454 **Joshi, M. S.; Kotru, P. N.** Hillocks on first-order prism faces of synthetic quartz —Errata [to 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 571, 1969.

For the original paper (ibid., v. 53, p. 825), the following corrections are made: on page 825, lines 7 and 9, page 829, lines 3, 6, and 9, page 835, line 6, and page 837, line 15, for [11$\bar{2}$0] read [10$\bar{1}$0].—Authors' correction

03331 **Jung, Peter.** A Pliocene molluscan faunule from Trinidad: Tulane Studies Geology and Paleontology, v. 7, no. 2, p. 85-92, illus., 1969.

A small molluscan fauna from a marine lens in the Caparo Clay Member of the Talparo Formation in the Mahaica District of central Trinidad consists of 12 species of pelecypods and 10 of gastropoda; 12 of the species occur also in a shell bed of the Talparo Formation in the Matura area of northeastern Trinidad, which contains a molluscan fauna of 160 species described in an earlier study (Jung, 1969), and the remaining 10 forms belong to genera represented at Matura. Correlation of the two faunas seems highly probable, as the lithologies of the beds are also strikingly similar.—VMJ

Kachadoorian, Reuben. *See* Ferrians, Oscar J., Jr. 03580

03460 **Kamb, Barclay.** Structural basis of the olivine-spinel stability relation—Errata [to 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 572, 1969.

Six corrections are listed for the original paper (ibid., v. 53, p. 1439-1455).—ESL

03147 **Karr, Clarence, Jr.; Kovach, John J.** Far-infrared spectroscopy of minerals and inorganics: Appl. Spectroscopy, v. 23, no. 3, p. 219-223, illus., tables, 1969.

Far-infrared spectroscopic analysis of minerals and inorganics was investigated. Far-infrared spectra, 200 to 50 cm^{-1} (50 to 200 μ), were obtained for 18 different minerals and inorganics, including 8 sulfides, 3 oxides, 3 carbonates, and 4 sulfates, many for the first time. Original analytical applications were made on samples of practical interest. These included the identification of cinnabar in a high-quartz ore, cuprite and tenorite in a mixture, calcite and dolomite in a coal refuse sample, dawsonite and dolomite in an oil shale, thenardite in a boiler deposit, and ferrous sulfate in the surface film on pyrite.—Authors' abstract

03080 **Kasahara, Keichi; Stevens, Anne E.** (editors). A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 183-235, illus., tables, 1969.

During the past 20 or more years, progress has been achieved in clarifying knowledge of seismic origins, other than the fault-plane work; approaches include new methods for analyzing teleseismic signals, studies on surface faulting, the physical theory of dislocations as support for theoretical progress, and the coupling of earthquake seismology to physics. The subject of this symposium represents typical interfield problems requiring cooperation from various branches of Earth science, and is closely related to one of the ultimate problems in seismology, the causes of earthquakes. Six of the seven papers presented review current status of the respective fields and survey problems for which further solutions are needed.—*from* Editors' foreword

03081 **Kasahara, Keichi.** Focal processes, and various approaches to their mechanism [with French abs.], *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 187-189, illus., 1969.

Wave radiation due to an abrupt change in the physical state of a certain earth volume is widely accepted as a concept of earthquake occurrence. A direct approach to focal processes is, therefore, to specify the 'state' as a function of various physical quantities and clarify the mode of its change in time and space with respect to each of the quantities. To further understand the processes, however, we need to know its background well, e.g., mechanism of trigger and rupture, mutual interaction with adjacent space, tectonic history, and source of energy. Cooperation of various branches in geoscience is urgently needed for successful approaches to the mechanism of focal processes. Problems for future progress in this research field are discussed from this point of view as introductory remarks to the following papers in this symposium.—Author's abstract

Kasper, Andrew. *See* Gensel, Patricia. 03519

Kauzmann, W. *See* Eisenberg, D. 03434

Kell, Klaus. *See* Frazer, Jane Z. 03447

03297 **Kelly, William C.; Goddard, Edwin N.** Telluride ores of Boulder County, Colorado: Geol. Soc. America Mem. 109, 237 p., illus., tables, 1969.

In Boulder County, classic examples of complex early Tertiary mineralization in Precambrian terrane have unusual variety produced in a single phase of hydrothermal deposition and cooling. In interlaced pyritic or marcasitic horn-quartz seams, 67 minerals have been recognized; individual polished sections contain a dozen or more intergrown metallic minerals, chiefly sylvanite, petzite, hessite and native gold, and calaverite and prennerite of some importance. Where mined in a few centers of structural control, there seems to be no bottom limit to the ores. Apparently the fluids rose from deep biotite latite through NW-trending breccia reef faults into NE-trending fissures. Microscopic study and experimental phase relations show that variety is due chiefly to differences in bulk composition of the fluids rather than to changes in temperature or confining pressure. Some original hypergene textures were modified by long cooling.—GDC

03339 **King, Cuchlaine A. M.; Buckley, Jane T.** Geomorphological investigations in west-central Baffin Island, N.W.T., Canada: Arctic and Alpine Research, v. 1, no. 2, p. 105-119, illus., 1969.

A variety of glacial, glaciofluvial, and periglacial forms are discussed. Glacial forms, especially striations and crag-and-tail, reveal effects of erosion by ice from the proto-Barnes icecap, reaching the coast 7,000 years ago. Glaciofluvial forms include deltas, eskers, and kames. A relationship between delta slope and stone size is established. Some esker-like ridges represent material collected in elongated hollows within dead-ice areas, rather than true eskers. The slope of kame terraces indicates

the ice-margin gradient. The effects of material size and shape on the nature of periglacial forms are considered. Ice-wedge polygons are best developed in well-sorted material. Finally, a number of icings, where spring water freezes during the winter, are described.—*from* Authors' abstract

King, Elizabeth R. *See* Zietz, Isidore. 03483

03351 **King, H. L.** Kenora district, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 1: Ontario Dept. Mines Misc. Paper 23, p. 17-31, illus., 1969.

Exploration in the district continued at a steady somewhat accelerated rate during 1968; projects are listed under the mining divisions. One base metal mining operation and a quarry producing crushed rock for ballast, are the only active mines. New geologic information in the Silver Lake area includes discovery of a mafic metavolcanic belt. New maps and literature are listed; geology of seven properties is reviewed.—ESL

King, Philip B. *See* Walker, George W. 03546

Kirk, J. L. *See* Schmidt, E. D. D. 03452

03512 **Kirkbright, G. F.; Rao, A. P.; West, T. S.** Indirect amplification determination of thorium by atomic absorption spectroscopy: Spectroscopy Letters, v. 2, no. 3, p. 69-74, 1969.

Thorium may not be determined by direct atomic absorption spectroscopy in flame media with appreciable sensitivity because of inefficient atomization. The optimum conditions for the most sensitive determination were: acidity, 0.15 F in HCl; phosphate concentration, 3.2×10^{-4} F; molybdate concentration, 2.3×10^{-3} F. The solutions and apparatus used to produce this are described. The molybdenum-thorium combining ratio in MThPA was found to be 10.8 ± 0.3:1. Other subjects discussed are the calibration graph and optimum concentration range, precision, and effect of diverse ions.—ESL

03505 **Klein, George de Vries.** Deposition of Triassic sedimentary rocks in separate basins, eastern North America: Geol. Soc. America Bull., v. 80, no. 9, p. 1825-1831, illus., 1969.

Orientation of thermal remanent magnetism shows that lava flows in the Connecticut and New Jersey Triassic basins are only partly equivalent. Paleocurrent analyses and potassium-argon dating of the Triassic sedimentary rocks and nearby pre-Triassic rocks indicate that the New Jersey Triassic basin was isolated, as were other Triassic basins in eastern North America. Preliminary paleocurrent data accord with the interpretation that the Connecticut Valley was an isolated basin. Sedimentary facies were probably deposited asymmetrically in the Connecticut and New Jersey basins.—WHN

02997 **Knapp, W. D.** Declinida, a new order of Late Paleozoic inadunate crinoids: Jour. Paleontology, v. 43, no. 2, p. 340-391, illus., 1969.

Inadunate crinoids having a structural concavity at the base of their dorsal cups, that is, a concavity in which the infrabasal plates are downflaring, are referred to the new order Declinida. These crinoids, ranging from Lower Mississippian through Lower Permian chiefly in the midcontinent region of North America, are derived from the Cladoidea, which have upflaring infrabasal plates; evolution of both orders is traced. Taxonomy of the new order is reviewed to the generic level; of the seven families, Phanocrinidae, Paradelocrinidae, and Protencrinidae are new. Thirteen new subfamilies are defined and 28 new genera, not all assignable to families, are diagnosed. The first major collection of Atokan crinoids is described, and 10 newspecies are figured from the Burgner Formation of southwestern Missouri.—VMJ

03158 **Knibbe, Willem Gerard Johan.** Potassium-calcium equilibria in clay fractions of some vertisols [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3577B, 1969.

03089 **Knight, William V.** Historical and economic geology of Lower Silurian Clinton sandstone of northeastern Ohio: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1421-1452, illus., 1969.

In northeastern Ohio, sandstone bodies assigned to the Lower Silurian Albion Group are western tongues of the continental Tuscarora Sandstone, intertonguing with marine shale. The main (Grimsby) tongue is the driller's "Clinton" sandstone. Cores and core logs indicate a delta-shelf, transitional environment, wherein hydrocarbons are trapped at 4,000-5,000-ft depths in channel-fill and bar sandstones containing evaporites. Reservoirs are erratically distributed; porosity and permeability are about 12 percent and 2 md, respectively; producible reserves should be less than 60 bbl of oil or 250 Mcf of gas per acre-foot, and net pay probably will not exceed 20 feet.—BHK

03005 **Kofford, Max E.** The Orphan Mine, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 190-194, illus., table, 1969.

The ore bodies at the Orphan mine northwest of Grand Canyon Village below Powell Point occur in and adjacent to a breccia pipe which outcrops in the Hermit Shale and Coconino Sandstone. The deposit consists of two major structural units: (1) a breccia pipe and (2) an annular ring—a zone of faulting, fracturing and slumping around the pipe. Pyrite is the most abundant sulfide followed by tennantite-tetrahedrite, chalcocite, uraninite, coffinite, and arsenopyrite.—KAF

02988 **Kohut, Joseph J.** Determination, statistical analysis, and interpretation of recurrent conodont groups in Middle and Upper Ordovician strata of the Cincinnati region (Ohio, Kentucky, and Indiana): Jour. Paleontology, v. 43, no. 2, p. 392-412, illus., tables, 1969.

Conodonts-elements in large collections from the Cincinnati region are referable to 94 form-species. Derivation of an index of affinity for every possible pair of form-species in the collections permits extraction from an initial matrix of recurrent groups of positively related form-species. These groups are then analyzed individually by rank-correlation techniques to reveal more direct relationships among member form-species. By these procedures, natural conodont communities are defined and later analyzed to determine constituent multielement associates, many of which may be regarded as the skeletal apparatuses of "natural" or "biologic" conodont species. Statistical analysis of the studied collections yielded results comparable with those derived from empirical analysis of the same collections.—*from* Author's abstract

03149 **Koren, John G.** Ultraviolet determination of elemental sulfur in ore: Appl. Spectroscopy, v. 23, no. 3, p. 275-276, illus., table, 1969.

Chloroform has not been generally used as a solvent in determination of sulfur, probably because of the low solubility (1.6 percent at room temperature), but it possesses several properties which outweigh this. It has greater transparency in the uv region, gives increased sensitivity, and is less noxious or toxic than carbon disulfide; also, the adsorption measurement can be made on the broad band at 280 nm. Applied to ore samples, particle size affects sulfur recoveries; better precision was obtained with finely ground samples. A table shows comparative results between 10 and 150-mesh material.—GDC

Koritnig, Sigmund. *See* Correns, Carl W. 03303

Kotru, P. N. *See* Joshi, M. S. 03454

Kovach, Jack. *See* Faure, Gunter. 03485

Kovach, John J. *See* Karr, Clarence, Jr. 03147

Kraemer, S. A. *See* Swain, F. M. 02962

03133 **Krammes, Jay Samuel.** Hydrologic significance of the granitic parent material of the San Gabriel Mountains, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3815B, 1969.

03583 **Krinsley, David; Margolis, Stanley.** A study of quartz sand grain surface textures with the scanning electron microscope: New York Acad. Sci. Trans., ser. 2, v. 31, no. 5, p. 457-477, illus., 1969.

A specialized field has developed concerned with environmental interpretation of the surfaces of sand grains. The scanning electron microscope is faster and gives more realistic photographs than the transmission electron microscope. It also allows observation of a larger number of grains at once, and shows greater detail. The rationale behind the use of sand surface textures for environmental interpretation is indicated, and preparation techniques for both instruments discussed. Criteria characteristic of the various environments are noted and pictured.—ESL

03410 **Kubiske, Edward P.** The challenge of ground water: Ground Water, v. 7, no. 3, p. 2-4, 1969.

Four questions that need to be answered before attempting to use ground water as a source of water supply are: (1) What is the local ground-water potential and cost of installing wells? (2) What is the cost of importing water? (3) Assuming the ground-water supply is lowered during the planning period, what will be the cost of replacing it? (4) What is the economic limit at which well water can be transported to a central facility? After a well system is established on an area-wide basis, the ground-water supply must be managed. So far this has been done by capturing rainfall and controlling withdrawal. Along the Huron River, Michigan, sewage plants contribute about 30 mgd of the flow. No one has studied the possibility of recharging the water table with storm or flood water and then augmenting the river flow with wells located so as to add 30 mgd when needed.—ESL

03440 **Kulin, Gershon.** (editor). Hydraulic research in the United States 1968: U.S. Natl. Bur. Standards Spec. Pub. 316, 319 p., 1969.

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1967-1968 are summarized. Projects from more than 200 university, industrial, state and federal government laboratories in the United States and Canada are reported.—Author's abstract

Kulm, L. D. *See* Griggs, G. B. 03304

03033 **Kuntz, Mel Anton.** Petrogenesis of the Buckskin Gulch intrusive complex, northern Mosquito Range, Colorado [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4227B-4228B, 1969.

03153 **Lachenbruch, Arthur H.** The effect of two-dimensional topography on superficial thermal gradients: U.S. Geol. Survey Bull. 1203-E, p. E1-E86, illus., tables, 1969.

In this paper, exact expressions are derived for the anomaly in the vertical surface heat flux caused by a plane slope and the corresponding analytical result is given for the plane slope that follows from Jeffreys' reference-plane assumption; the two results are compared. Upper and lower limits are given for heat flow where two plane slopes coexist to form a plane valley, ridge, or bench; a procedure is described for bracketing the anomaly due to a general slope by exact results for plane slopes, and 1st and 2nd methods for terrain corrections are combined for approximating and bracketing effects of a general slope; conditions for neglecting gentle slopes at the station are derived; variation of the topographic anomaly with depth in discussed; and transient effects are considered.—*from* Author's introduction

LaMoreaux, P. E. *See* Powell, W. J. 03302

Lamoreaux, R. D. *See* Herzenberg, C. L. 03342

Lane, N. Gary. *See* Beus, Stanley S. 03120

03176 **Lange, Ian Muirhead.** Sulfur isotope geology of Butte, Montana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3792B, 1969.

03623 **Langenbahn, W. E.** Hamon, Toro and Rojo Caballos West fields, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 75-79, illus., 1969.

03356 **Laporte, Léo F.** Paleoecology—Fossils and their environments: Jour. Geol. Education, v. 17, no. 3, p. 75-80, illus., 1969.

Since publication of the *Treatise on marine ecology and paleoecology* (Hedgpeth and Ladd, 1957), interest, especially in invertebrate marine paleoecology, has been greatly expanded. Three factors determine specific character of fossil assemblages: evolutionary stage of component members, local environment, and biogeographic province. Modern theory of organic evolution emphasizes adaptation of the organism to meet requirements imposed by its environment. Paleoecology also contributes to related fields of stratigraphy and sedimentology. Clues are in comparative forms in present day modes of life, concepts of niche and habitat, and definition of community. Time dimension is another level of inquiry in analysis of niche and community evolution, differentiated by changes in species and stratigraphic facies. Environmental stratigraphy is thus an important preliminary to paleoecological analysis.—GDC

03569 **Laporte, Léo F.** Recognition of a transgressive carbonate sequence within an epeiric sea, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 98-119, illus., tables, 1969.

The regional, late Silurian-early Devonian, marine transgression of the central Appalachians is represented in New York by a shallow-water carbonate sequence (Helderberg Group) which locally transgressed northward and westward. The resultant stratigraphic section comprises several hundred feet of fossiliferous limestones which exhibit several distinctive sedimentary facies. The four major facies recognized are: (1) supratidal-intertidal (Manlius Formation in part); (2) shallow subtidal, above water base, either protected (Manlius Formation in part) or open (Coeymans Formation); (3) subtidal, below wave base, without terrigenous clastic influx (Kalkberg Formation in part); and (4) subtidal, below wave base, with intermittent terrigenous influx (Kalkberg Formation, in part, and the New Scotland Formation).—KAF

03034 **Laughlin, Alexander William.** Excess radiogenic argon in pegmatite minerals [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4228B, 1969.

02991 **Lawrence, David R.** The use of clionid sponges in paleoenvironmental analyses: Jour. Paleontology, v. 43, no. 2, p. 539-543, illus., 1969.

The use of borings of demosponges of the family Clionidae to determine life or postmortem orientation of host organisms (mainly living, thick-shelled pelecypods) is hampered by complex spreading patterns of the sponges. However, two perforation and gallery forming groups, *Cliona vastifica* and *C. celata*, can be recognized in both Recent and ancient settings and may be useful in paleoenvironmental studies. Both forms were recognized in a late Oligocene oyster community exposed in a channel deposit at Belgrade, N.C.—*from* Author's summary

03035 **Lawrence, Robert Dale.** The Eightmile Creek fault, northeastern Cascade Range, Washington [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4228B-4229B, 1969.

Lazo L., Eduardo. *See* James, David E. 03393

03074 **Lee, Charles H.; Praszker, Michael.** Bay mud developments and related structural foundations, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 41-85, illus., tables, 1969.

This report discusses the engineering problems related to fill stability, fill settlement and the response of the underlying bay mud to its superimposed loads. Settlement measurements made on existing fills have been assembled, and future settlement and differential settlements for various thicknesses of fill and depth of mud have been analyzed theoretically. The effect of mud displacement beyond fill boundaries has also been studied from field observation. Recommendations dealing with good engineering practice are presented together with basic concepts justifying such recommendations.—KAF

03364 **Leestma, Roger A.; White, Richard A.** (principal investigator; editor). Earth resource surveys from spacecraft—Sample analyses and interpretations relating to agriculture, cartography, forestry, geography, geology, hydrology, oceanography, V. 1-2: Houston, Tex., Natl. Aeronautics andSpace Adm., Earth Resources Group, sections paged separately, illus. [1969?].

These volumes illustrate some of the applications of spacecraft surveys to the Earth. Preliminary sections cover potential uses of orbital imagery for inventory of Earth resources, and the sensors to be used. The main text discusses applications to: agriculture, cartography, forestry, geography, geology, hydrology, and oceanography. A final section includes reactions, responses, and recommendations. One appendix indicates applications to meteorology, and another shows plotted geographic locations of photographs taken.—ESL

03377 **Leestma, Roger A.** Potential applications and benefits of satellite photography, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. H6, [1969?].

Manned orbiting satellites equipped with multisensor systems will soon be able to measure and sense the total land, ice, and water surfaces of the Earth. New studies can be compiled from radar, infrared, visual photography, etc. taken at the same time. Also the satellites can return at intervals to compare data. We can now study the effects of man-made changes on the hydrologic cycle.—ESL

Leist, C. E. *See* Ball, M. M. 03301

03520 **Lespérance, P. J.; Greiner, H. R.** Squatec-Cabano area, Rimouski, Rivière-du-Loup and Temiscouata Counties [also French edition]: Quebec Dept. Nat. Resources Geol. Rept. 128, 111 p., illus., tables, geol. maps, 1969.

Oldest rocks in the area belong to the Quebec Group, Cambrian?-Ordovician, the older part forming the core of a major anticline. All eras are represented up to Lower Devonian. The thickness, stratigraphy, petrography, and fossil lists are given for each formation. The unconsolidated deposits are related to the Pleistocene periods. Intrusive rocks are divided into post-Quebec Group, post Lower Silurian, and Devonian,. Nonmetallic minerals are produced. An appendix contains a section at Pointe Brulée.—ESL

03016 **Lessentine, Ross H.** Kaiparowitz and Black Mesa basins—Stratigraphic synthesis, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 91-113, illus., reprinted 1969; originally published 1965.

This article is reprinted from Am. Assoc. Petroleum Geologists Bull., v. 49, no. 11, p. 1997-2019, 1965. (*See* Abstracts of North American Geology, April 1966.)—KAF

03321 **Liao, K. H.; Scheidegger, A. E.** Theoretical stream lengths and drainage areas in Horton nets of various orders: Water Resources Research, v. 5, no. 3, p. 744-746, tables, 1969.

The paper presents tables of calculations of the expected stream lengths and drainage areas of Strahler streams of various orders for networks with various numbers of first order streams based on the random-graph model of such networks.—Authors' abstract

03482 **Lindsey, David A.** Glacial sedimentology of the Precambrian Gowganda Formation, Ontario, Canada: Geol. Soc. America Bull., v. 80, no. 9, p. 1685-1701, illus., table, 1969.

In the Gowganda Formation, part of the thick Huronian sequence in central Ontario, till-like conglomerates, varved argillites, and abundant dropstones provide strong evidence for glacial origin. Local thin-bedded sandstones with flame structure, graded bedding, contorted bedding and rippled tops are associated with varved argillites and dropstones and indicate turbidity current deposition in a glaciolacustrine environment. The distribution of varved argillite, silty limestone, and probable marine argillites suggests a northern fresh water facies and a southern marine facies. Pebble fabrics in conglomerate and ripple marks in sandstone indicate a south-trending sediment transport system. Gowganda ice sheets eroded a northern plutonic terrane and transported the debris southwards to form the Gowganda Formation.—*from* Author's abstract

Lineback, Jerry A. *See* Jacobs, Alan M. 03396

03122 **Lipps, Jere H.** *Triquetrorhabdulus* and similar calcareous nannoplankton: Jour. Paleontology, v. 43, no. 4, p. 1029-1032, illus., 1969.

Triquetrorhabdulus Martini includes a single species of calcareous nannoplankton, *T. carinatus* Martini, that occurs in warm-water plankton assemblages in the lower Miocene (*Globigerina ciperoensis ciperoensis* through *Globorotaloides stainforthi* Zones) of equatorial Pacific Ocean, California, and worldwide. The new family Triquetrorhabdulaceae is erected to accomodate this unique genus, which is characterized by trigonal rods with flat-topped bars 120° apart running their length and with irregular concave surfaces between bars. Orientation of the rods during life is conjectural, but apparently they formed an intracellular skeleton. Species formerly assigned to this genus, or resembling it superficially, are briefly discussed.—*from* Author's abstract

03508 **Lipps, Jere H.** Tertiary plankton from the Clipperton fracture zone, equatorial East Pacific: Geol. Soc. America Bull., v. 80, no. 9, p. 1801-1808, illus., table, 1969.

Deep-sea cores, collected from an area of rough topography along the Clipperton fracture zone, yielded lower Miocene through Holocene planktonic foraminifera and calcareous nannoplankton. The species permit correlation of the cored sediments with the low-latitude plankton biostratigraphic zones and the Californian and European Stages. Paleobiogeographic plankton provinces are analogous to modern ones, suggesting that the general water mass and current patterns were similar throughout the Neogene. The sediment ages indicate that the sea floor in the east-central Pacific may have spread at a faster rate during pre-late Miocene time than during post-late Miocene time.—Author's abstract

02985 **Loeblich, Alfred R., Jr.; Tappan, Helen.** Annotated index and bibliography of the calcareous nannoplankton, [Pt.] 3: Jour. Paleontology, v. 43, no. 2, p. 568-588, 1969.

This annotated index includes 615 entries, referring to modern and fossil nannoplankton taxa of all levels, in addition to those appearing in the earlier index and bibliography and supplement. New taxa and new combinations are cross referenced, and invalid or illegitimate taxa are indicated. In addition to references cited in the index to taxa, the bibliography of 216 entries includes supplemental publications concerning all phases of calcareous nannoplankton studies, taxonomic, stratigraphic, morphologic, or biochemical.—*from* Authors' abstract

Lorentzen, George R. *See* Zietz, Isidore. 03483

Louis, M. C. *See* Flory, D. A. 03655

03503 **Lovejoy, Earl M. P.** Mount Rose, northern Carson Range, Nevada—New light on the late Cenozoic tectonic history of the Sierra Nevada from a classic locality: Geol. Soc. America Bull., v. 80, no. 9, p. 1833-1841, illus., 1969.

Louderback indicated that more than 5,000 feet of post-Miocene-Pliocene displacements occurred along the eastern front of the Carson Range at the Mount Rose cross section. He concluded that the entire Carson Range (hence the Sierra) was uplifted as a block along the frontal fault in post-late Miocene time. The structural evidence at Mount Rose has been re-examined. It may be reinterpreted as the result of formation of a strato-volcano over a rough terrain, and its subsequent deep erosion, as contrasted with the earlier interpretation involving major fault displacement after agglomerate and flow deposition. The new structural evidence and interpretation indicates that there has been little significant faulting along the Sierra Nevada front at Mount Rose since Miocene-Pliocene volcanism.—*from* Author's abstract

Lowell, Brent H. *See* Morgan, Charles O. 03545

03563 **Lowenstam, H. A.** Ecologic criteria for recognition of depositional environments in carbonate rocks [abs.], *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 192, 1969.

03370 **Lowman, Paul D., Jr.** Experiment S-5, synoptic terrain photography—Gemini VII, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. E53-E60, illus. [1969?].

A photo taken with infrared film, and covering the Gulf Coast from Mobile Bay to New Orleans is included with four covering areas in Africa and the Arabian Peninsula. This film penetrates haze, demonstrating its value for hyperaltitude photography. Depth of water can be gauged by the water color.—ESL

03408 **Lyon, R. J. P.** Remote sensing in exploration—Can we use it when we get it? [abs.]: Houston Geol. Soc. Bull., v. 11, no. 8, p. 34-35, 1969; Corpus Christi Geol. Soc. Bull., v. 9, no. 7, p. 11-13, 1969.

MacKevett, E. M., Jr. *See* Jones, D. L. 03155

03367 **MacPhail, Donald; Smith, Albert; Vermeer, Donald.** Geomorphic area analyzed from a space photo, *in* Earth resource surveys from spacecraft, V. 1 (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. E4, illus. [1969?].

The Rio Grande valley cuts diagonally across this earth-orbital photo showing Texas and Mexico in the El Paso-Juarez area. Interpretation is on the overlay and in a brief text. Geomorphic areas identified are a typical assemblage of landforms and soils in a mature arid landscape; clues leading to their recognition and delineation are listed —ESL

03372 **MacPhail, Donald D.; Smith, Albert W.; Vermeer, Donald E.** Waters of the land —Drainage patterns, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. F3-F4, illus. [1969?].

Three considerations help in determination of drainage lines on the satellite photograph: tonal contrast, pattern, and intuitive feel for the environment in arid areas.—ESL

03578 **Maddock, Thomas, Jr.** The behavior of straight open channels with movable beds: U.S. Geol. Survey Prof. Paper 622-A, p. A1-A70, illus., tables, 1969.

It is the thesis of this report that, to some degree, it is impossible to achieve unique or determinate relations among velocity, depth, slope, and rate of sediment movement in alluvial channels. Usable relations among discharge, mean velocity, and load for transport of sediment of uniform size in a channel of symmetrically distributed velocities are only partially applicable for mixtures of sediment sizes and for odd-shaped channels. Any function containing slope as a parameter will be indeterminate within wide limits. The three major parts of this report (1) evaluate the role of sediment transport in fluvial hydraulics, (2) analyze two-dimensional flow (width not

considered), and (3) study the effect of introduction of width (3-dimensional flow) on principal variables and consider elements of channel stability.—VSN

03042 **Madison, James Ambrose.** Petrology and geochemistry of the Webster-Addie ultramafic body, Jackson County, North Carolina [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4229B, 1969.

Madsen, Beth M. *See* Murata, K. J. 03592

Major, M. W. *See* Romig, P. R. 03597

03190 **Malan, Roger C.** Uranium in the Tertiary intermontane basins of Colorado: Mtn. Geologist, v. 6, no. 1, p. 45-51, illus., 1969.

The occurrences of uranium in Colorado are in the deep Middle Park, South Park, and Raton basins, and in smaller upland basins along the eastern margin of the Thirty-nine Mile volcanic field northwest of Canon City. Only the Tallahassee Creek locality in the upland basinal system has produced significant ore. The ores in Colorado are related to volcanic fields, principally of Oligocene age, where favorable fluvial host beds are: subjacent to the volcanic piles in the upland basins, or subjacent to volcaniclastic outwash and tuffaceous lake beds in deeper basins near the volcanic piles. During the past two years, nearly one-half million acres have been acquired for uranium exploration and several deep exploratory drilling efforts have been started. —*from* Author's abstract

Mamay, S. H. *See* Skog, Judith E. 03550

Mamet, Bernard L. *See* Sando, William J. 03596

Manning, R. B. *See* Brooks, H. K. 03492

03384 **Manton, S. M.** Evolution and affinities of Onychophora, Myriapoda, Hexapoda, and Crustacea, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R15-R56, illus., 1969.

Phylogenetic relationships among arthropods are essentially speculative; there is evidence of polyphyletic origin, with several lines derived independently from segmented coelomates. Early arthropod evolution is here interpreted by analysis of relationships between body structure, locomotory and other mechanisms, and life habits of extant forms. Evolution and relationships are discussed for: Onychophora (formerly considered intermediate between annelids and arthropods); four classes of Myriapoda, and Hexapoda (insects); and Crustacea. Relation of Onychophora to ancestors of myriapods is based on body structure and embryonic development; myriapods and hexapods are likewise related. Crustacea have evolved independently of the above group and also of Trilobita and Merostomata.—VMJ

03488 **Manton, S. M.** Introduction to the classification of Arthropoda, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R3-R15, illus., 1969.

Main divisions of the phylum Arthropoda, here listed consist of 9 superclasses, 22 classes. Excluding the poorly known Pycnogonida, Pentastomida, and Tardigrada, three major groupings are made on the basis of tagmata (trunk divisions) and structure of jaws and trunk limbs: Trilobitomorpha (2 classes), Chelicerata (Merostomata, Arachnida); Crustacea (9 classes); Onychophora, Myriapoda (5 classes), Hexapoda (Insecta and 4 small classes). Arthropoda appear to be polyphyletic; phylogeny is complicated by convergences in evolution of biramous limbs, mandibles, and other features. Basic unity of Onychophora-Myriapoda-Hexapoda is shown, although no hexapod class is closely related to any myriapod class.—VMJ

Margolis, Stanley. *See* Krinsley, David. 03583

03644 **Martin, J. Stewart.** Oil and gas exploration in West Texas, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 3-4, 1969.

Exploration developments in west Texas since 1966 indicate there is continuing production and opening of new fields in the Central Basin Platform, Northwestern Shelf, Delaware-Val Verde basins, and Ozona Platform, and a slower exploration pace on the Eastern Shelf and in the Midland Basin. Although no oil or gas in commercial amounts have been found in the more remote areas of the greater Permian Basin, it remains an intriguing challenge to explorationists.—MCM

Martin, Ray G., Jr. *See* McKelvey, V. E. 03513

03123 **Martin, Robert A.** Taxonomy of the giant Pleistocene beaver *Castoroides* from Florida: Jour. Paleontology, v. 43, no. 4, p. 1033-1041, illus., tables, 1969.

Castoroides is recorded from 25 Pleistocene localities in Florida: 23 of Rancholabrean age, one possibly Irvingtonian, and one late Blancan. Rancholabrean specimens from Santa Fe River are referred to a new subspecies, *C. ohioenses dilophidus*, characterized by a dilophid condition in the lower fourth premolar and upper third molar. One sample of this subspecies includes teeth of very young individuals, which are similar to those of adult *Dipoides*. Femora of *dilophidus* are not proportionally different from those of *Castor canadensis*, but are about 50 percent longer than those of the living beaver. Taxonomic status of *Paradipoides stovalli* and *Dipoides rexroadensis* are doubtful. The holotype of *Burosor effosorius* is referred to *Castoroides.—from* Author's abstract

03043 **Matter, Philip, 3d.** Petrochemical variations across some Arizona pegmatites and their enclosing rocks [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4229B-4230B, 1969.

03011 **Mayou, Taylor V.** A new species of Permian ophiuroid from Nevada: Jour. Paleontology, v. 43, no. 4, p. 936-940, illus., tables, 1969.

Twenty-three nearly complete specimens and many broken parts of *Archaeophiomusium bispinosum* n.sp., and two specimens of *A. burrisi* (Miller), were collected from the Leonardian Pequop Formation in the Maverick Springs Range, eastern Nevada. Preservation is exceptional, for many nearly complete jaw structures can be seen on exposed oral surfaces; some retain the teeth in place. Spines are preserved on the arms of almost every specimen. Tentacle pores are preserved on the oral side of the arms, two pores per segment; tentacle scales still cover the pores on some segments. *A. bispinosum* has an aboral disk plate arrangement similar to that in *A. burrisi*, and in addition bears a series of smaller secondary interradial plates inserted between the main plates.—*from* Author's abstract

03099 **McCallum, Henry D.; Hinyard, Paul.** Andrew Clemmons Wright (1893-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1527-1528, portrait, 1969.

03119 **McCammon, Helen M.** The food of articulate brachiopods: Jour. Paleontology, v. 43, no. 4, p. 976-985, illus., tables, 1969.

Analysis of stomach contents, laboratory observations of feeding behavior, the anatomy of the digestive system, and present-day geographic distribution of brachiopods furnish evidence indicating that dissolved and colloidal organic nutrients are the primary foods of articulate brachiopods, with plankton accounting for only a minor portion. Articulate brachiopods are not as common in the marine environment as other filter feeders, but in polar and subpolar areas where organic nutrients occur in high concentrations, populations rival fossil deposits in the Paleozoic. It is felt that in geologic history brachiopods declined when the nutrient-rich areas disappeared, either because of major shifts in oceanic currents, drastic decrease of nutrients reaching the ocean, or change in chemical or physical composition of the nutrients.—*from* Author's abstract

McComas, Murray R. *See* Hackett, James E. 03398

McCormick, Lavon. *See* Moore, Raymond C. 03385

03078 **McCubbin, Donald G.; Brady, Michael J.** Depositional environment of the Almond reservoirs, Patrick Draw field, Wyoming: Mtn. Geologist, v. 6, no. 1, p. 3-26, illus., tables, 1969.

The Cretaceous upper Almond Formation, the main reservoir sandstone, is a composite shoreline deposit, partially replaced updip by lagoonal shales. The UA-5 reservoir sandstone consists of a 'western bar' and younger 'eastern bar' that partly overlaps the western bar. The western bar rests sharply on coal of the underlying cycle. Both sandstone bodies contain transported pelecypods and some foraminifers, and show burrow structures including *Ophiomorpha*. Stratification shows deposition in nearshore-marine and beach environments on a seaward-prograding shoreline. An initial transgression was followed by deposition in progressively more shallow shorelines. The lagoon facies over the western bar may be partly equivalent to the eastern bar; oysters are common and are the main part of coquina beds. Arenaceous foraminifers occur in the lagoon rocks, as do structures formed by burrowing animals.—*from* Authors' abstract

02967 **McDonald, Barrie C.** Glacial and interglacial stratigraphy, Hudson Bay Lowland, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 78-99, illus., table, 1969.

Subtill nonglacial sediments which include marine strata, peat and stream deposits are widespread in the Hudson Bay Lowland. The presence of interglacial marine strata in the Lowland, and of marine-shell fragments in tills west of long 86° W., indicate that Hudson Bay was a depression occupied by the sea at least as early as Sangamon time. Glacial events postdating the interglacial are recorded throughout the Lowland by two tills that are locally separated by proglacial-lake sand and silt. Lake Agassiz may have drained eastward to the sea near the present Fawn River shortly after 7,400 yr B.P. (C-14 age determination). In the central part of the Lowland, evidence of a postglacial lake phase is absent, while in the southeastern part there is possible evidence of glacial lake Barlow-Ojibway.—KAF

03416 **McGarr, Arthur.** Amplitude variations of Rayleigh waves—Horizontal refraction: Seismol. Soc. America Bull., v. 59, no. 3, p. 1307-1334, illus., tables, 1969.

Amplitudes of the vertical component of ground motion caused by Rayleigh waves with periods of about 20 sec were measured over an array consisting of 25 stations over the United States. Patterns of amplitude measured by the array are highly sensitive to epicentral location; a pattern appears to change continuously with change in epicenter. Striking fluctuations of amplitude (by a factor of 10 or more) appear to be caused by focusing due to lateral variations in phase velocity; they cannot be explained by other factors. Analysis based on a simple model of a horizontal variation in phase velocity yields theoretical amplitude patterns that explain the size and character of the most prominent variations in amplitude. Amplitudes of long-period P waves appear to vary about 1/4 as much as those of Rayleigh waves in the array—*from* Author's abstract

03417 **McGarr, Arthur.** Amplitude variations of Rayleigh waves—Propagation across a continental margin: Seismol. Soc. America Bull., v. 59, no. 3, p. 1281-1305, illus., tables, 1969.

Seismograms from Berkeley and from a site on the deep ocean bottom off California were compared to ascertain the effect on Rayleigh waves of propagation across the continental margin. In the 14- to 25-sec period range and for near-normal incidence, the amplitudes of vertical displacement on the ocean bottom were two-thirds to one-third as large as those at Berkeley. Amplitude ratios for waves propagating in either direction across the margin are consistent within experimental error. Comparison of experimental amplitude ratios with ratios calculated by the variational technique of McGarr and Alsop (1967) suggests a striking contrast in structure between Berkeley and the ocean-bottom site about 235 km WNW of Berkeley. The velocities and densities of the lower crust and upper mantle beneath the oceanic site are much higher than those beneath Berkeley.—*from* Author's abstract

03613 **McGee, D. A.** The Earth—Our provider: Mines Mag., v. 58, no. 7, p. 19-21, illus., 1969.

This article is the text of the commencement address to graduating seniors of the Colorado School of Mines in June 1968. The mineral resources of the Earth are adequate and through human ingenuity and new technology, it will be possible to extract minerals from the earth and sea in sufficient quantities and at a cost to meet anticipated demand.—KAF

03405 **McGinley, John R., Jr.; Anderson, Don L.** Relative amplitudes of P and S waves as a mantle reconnaissance tool: Seismol. Soc. America Bull., v. 59, no. 3, p. 1189-1200, illus,. tables, 1969.

The unified magnitude, the ratio of the amplitudes of S to P waves, and traveltime residuals were compiled from published data for five Seismological Observatories. Using one of the stations as a reference, a relative measure of the above quantities was calculated for each of the other stations for each of a number of earthquakes. The stations in the Basin and Range Province are consistent with a markedly higher attenuation of P-waves and a high attenuation of S relative to P when compared to the other stations, the latter indicating a high Poisson's ratio in the mantle under the Basin and Range. BMO, in eastern Oregon, has a high S/P amplitude ratio compared to other stations and a traveltime residual that is comparable to the observatories in the midcontinent. This may be another example of a seismic "window" into the upper mantle that is generated by underthrusting of the oceanic lithosphere.—*from* Authors' abstract

03092 **McGrain, Preston.** Extension of Lost River Chert across parts of Kentucky: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1506-1507, illus., 1969.

The Lost River Chert is a distinct lithologic unit in the Ste. Genevieve Limestone (Upper Mississippian) in southern Indiana and west-central Kentucky, on the west side of the Cincinnati arch. The author shows that this distinct unit extends further south on the west side of the arch than previously recorded and concludes that a stratigraphically equivalent unit is present in the Ste. Genevieve, east of the arch in southern Kentucky and northern Tennessee.—SEF

03599 **McGuinness, C. L.** New thrusts in ground water: Ground Water, v. 7, no. 2, p. 7-10, 1969; *slightly revised*, Oklahoma Geology Notes, v. 29, no. 3, p. 71-76, 1969.

Four principal trends in ground water are apparent and involve increasing use (1) of ground water for domestic supplies, (2) of aquifers as possible storage media for surplus flood water, (3) of saline aquifers as sources of water supply, and (4) of all aquifers as possible storage media for waste effluents. A systems analysis approach is needed to develop a working model of a given hydrologic and socio-economic problem.—*from* Author's abstract

03063 **McKee, Edwin D.** Paleozoic rocks of Grand Canyon, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 78-90, illus., 1969.

Each of the principal Paleozoic formations found in the Grand Canyon is described briefly and its genesis is evaluated in the light of recent studies. Facies changes and other lateral variations encountered from one end of the Grand Canyon to the other are discussed and unconformities of special significance are described and evaluated.—KAF

03117 **McKee, Edwin H.; Gangloff, Roland A.** Stratigraphic distribution of archaeocyathids in the Silver Peak Range and the White and Inyo Mountains, western Nevada and eastern California: Jour. Paleontology, v. 43, no. 3, p. 716-726, illus., 1969.

Archaeocyathids from the White and Inyo Mountains and Silver Peak Range of California and Nevada occur in the middle one-third (approximately 2,000 feet) of

the Lower Cambrian section as defined by the olenellid biozone. Three assemblages are recognized and can be correlated throughout the region by stratigraphic position. The lowest known occurrence of an archaeocyathid, *Ethmophyllum*, is found approximately 1,000 feet above the lowest olenellid trilobite *Fallotaspis*. The upper archaeocyathid assemblage, which is characterized by *Coscinocyathus*, occurs approximately 3,000 feet below the uppermost olenellid fauna.—Authors' abstract

03513 **McKelvey, V. E.; Wang, Frank F. H.; Quinterno, Paula; Hayden, Sandi; Alpha, T. R.; Martin, Ray G., Jr.** (compilers). World subsea mineral resources: U.S. Geol. Survey Misc. Geol. Inv. Map I-632, 4 sheets, scales 1:60,000,000 and 1:39,283,200 at equator (van der Grinten projection), separate text, 1969.

The four sheets in this set of preliminary maps show: (1) (smaller scale) petroleum, phosphorite, manganese-oxide nodules, and metal-bearing mud; (2) geologic and physiographic provinces, subsea underground mines, and coastal placer deposits; (3) potential petroleum resources; and (4) saline minerals, sulfur, phosphorite, manganese-oxide nodules, and metal-bearing mud. Petroleum, produced from the seabed offshore 25 countries, makes up nearly 90 percent of total value of current subsea mineral production, and 17 percent of world's supply which may be raised to 35 percent by 1980. Favorable areas lie adjacent to nearly every coastal nation. Potential resources of other minerals from continental shelves are large, but because of availability of lower cost land sources for most of them, subsea production is likely to furnish only a small part of world output.—MCM

03000 **McKinney, Frank K.** Organic structures in a Late Mississippian trepostomatous ectoproct (bryozoan): Jour. Paleontology, v. 43, no. 2, p. 285-288, illus., 1969.

A single specimen of *Tabulipora cestriensis* (Ulrich) from the Bangor Limestone (Late Mississippian) of Alabama contains numerous remnant organic structures, including several cuticular tubes extending through perforate diaphragms, a dark structure lining a mesopore tube, and "brown bodies". The cuticular tubes may be analogous with membranous sacs in Recent cyclostomatous ectoprocts (bryozoans), and the "brown bodies" represent either degenerate polypides or are a sedimentary infiltration phenomenon.—Author's abstract

McKnight, Edwin T. *See* Pratt, Walden P. 03640

03177 **McKnight, John Forrest.** Geology of Bofecillos Mountains area, Trans-Pecos Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3792B, 1969.

McNellis, Jesse M. *See* Morgan, Charles O. 03545

McPhail, Donald. *See* Smith, Albert. 03379

03167 **McPherson, Ronald Bruce.** Static response of flexible domes buried in sand [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3776B, 1969.

03067 **Mereu, R. F.** Curvature effects on Hudson Bay and Project Early Rise—Seismic refraction results, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 315-325, illus., table, 1969.

The effect of the Earth's curvature on crustal and upper mantle seismic refraction investigations was examined to determine under what conditions flat Earth assumptions are valid. When curvature corrections were applied to Hudson Bay, Early Rise, and 1963 Lake Superior experiments, it was found that: (1) the P_n velocities were reduced by 0.05 kmps to 8.20 ± 0.03 kmps (Hudson Bay) and 8.05 ± 0.02 kmps (Lake Superior); (2) a high velocity layer, 8.43 kmps, was found at a depth of 84 km in the upper mantle under the Canadian Shield; and(3) other parameters such as time-terms, refractor depths, and error calculations were not affected significantly. Data show that the boundary between the Superior and Churchill geological provinces is deep-seated; the crust under Churchill province is 5 to 10 km thicker than under Superior province; and the boundary, which is not well defined under Hudson Bay near the surface, may be well marked at depth.—*from* Author's abstract

Merritt, Gary L. *See* Emrich, Grover H. 03414

03577 **Mertie, John B., Jr.** Economic geology of the platinum metals: U.S. Geol. Survey Prof. Paper 630, 120 p., illus., tables, geol. map, 1969.

This paper is a treatise on the discovery, occurrence, physical properties, mineralogy, chemical composition, genesis, and economic value of the platinum metals of the world. The principal sources of the six platinum metals are in Canada, Union of Soviet Socialist Republics, and the Republic of South Africa, with minor sources in Colombia and Alaska. The deposits of the three major producers are described in detail, and a placer deposit in Alaska, the Goodnews Bay district, owing to its national importance, is also fully described. Suggestions are offered for further exploration in Alaska. A comprehensive bibliography is included.—JBM

03095 **Meyerhoff, Howard A.** Early Paleozoic (Arbuckle) overlap, southern midcontinent, United States—Discussion [of paper by P. A. Chenoweth, 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1519-1520, 1969.

The pre-Late Cambrian floor described by Chenoweth (ibid., v. 52, no. 9, p. 1670-1688, 1968) has too much relief to be described as a peneplane.—SEF

03605 **Middleton, R.** (compiler). Jamieson Township, District of Cochrane (geophysical series): Ontario Dept. Mines Prelim. Geol. Map P. 521, scale 1 in. to 1/4 mi., text, 1969.

All of the rocks of Jamieson Township, with the exception of the north-south diabase dikes (Matachewan) are Archean volcanics, sediments, gabbros, diorites, granites, and aplites. Varved clay, sand, and gravel of Pleistocene age cover the township. Distribution of bedrock on this map shows only large features and areas of predominating rock type; a detailed preliminary geologic map will be published later. Isoclinal folding is evident and long wavelength cross folds may be present; three major fault systems were noted. Sulfides, pyrite, and quartz occurrences have been found. A relative, vertical component, ground magnetic picture was obtained by utilizing surveys donated to the project and surveys filed as assessment work. Irregular bedrock topography and depth of overburden greatly influence interpretation of geophysical data and effectiveness of geophysical techniques.—MCM

03532 **Miller, Fred E.** Linear programming of Osage County resources—A preliminary report, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 25-27, 1969.

The goal of optimal utilization of a region's mineral resources has been widely discussed and has been approached from several points of view. Heretofore, no known application of linear programming to this problem is in existence. This study is an attempt to devise such a model. Osage County, rich in unexploited mineral reserves, was chosen as an ideal basis for a closed-region linear programming model. The model contains 43 activities which are operated subject to 18 constraints. Optimal solutions can be determined analytically for any desirable objective that is data-possible, such as maximizing the corporate profits within the County.—Author's abstract

03554 **Miller, George J.** A new hypothesis to explain the method of food ingestion by *Smilodon californicus* Bovard: Tebiwa, v. 12, no. 1, p. 9-19, illus., tables, 1969.

A revision of previous reconstructions of the mouth of *Smilodon californicus* Bovard is presented. Recent data concerning tooth wear and its possible relationship to the eating habits of *Smilodon* are discussed.—Author's abstract

03555 **Miller, George J.** A study of cuts, grooves, and other marks on Recent and fossil bone—[Pt.] 1, Animal tooth marks: Tebiwa, v. 12, no. 1, p. 20-26, illus., 1969.

The marks made by captive animals while chewing and gnawing on fresh bone are discussed. A comparison is made of these marks with cuts and grooves on fossil bone from Rancho La Brea and other paleontological sites.—Author's abstract

02989 **Miller, James F.** Conodont fauna of the Notch Peak Limestone (Cambro-Ordovician), House Range, Utah: Jour. Paleontology, v. 43, no. 2, p. 413-439, illus., tables, 1969.

The Notch Peak Limestone, about 1800 feet thick in sections between Steamboat Pass and Notch Peak, is divided into six informal members; the two youngest members, about 475 feet thick, yielded abundant conodonts of Cambrian and earliest Ordovician age. The Early Ordovician trilobite *Symphysurina* and typical Ordovician conodonts *Cordylodus*, *Oneotodus*, *Acodus*, *Acontiodus* were found in the top 180 feet of the formation, which had previously been considered entirely Late Cambrian in age. The 12,328 identified conodont specimens are referred to 13 genera, of which *Fryxellodontus*, *Hirsutodontus*, *Proconodontus* are new. Of 29 species, 21 are new. New multielement species *Fryxellodontus inornatus and F. lineatus* are reconstructed on the basis of symmetry transitions.—VMJ

02981 **Miller, John David.** Fluid-inclusion temperature measurements in the East Tennessee zinc district: Econ. Geology, v. 64, no. 1, p. 109-110, illus., 1969.

Bubble-disappearance temperatures for fluorite range from 100° to 280°C, with 76 percent of the determinations falling between 170° and 230°C. These values are notably higher than those for Mississippi Valley and seem to rule out ground-water origin.—WSW

03323 **Mills, Herbert G.** Geology of the Tom O'Connor field, Refugio County, Texas: South Texas Geol. Soc. Bull., v. 9, no. 9, p. 7-22, illus., 1969.

In the Tom O'Connor field, discovered in 1964, large oil and gas accumulations occur in the Oligocene and dry gas in the Miocene-Pliocene, with increasing percentages of gas in the younger sandstones. Recovery is expected to be over 500 million barrels of oil and one trillion cubic feet of gas. The trap is an anticline on the downthrown side of the Vicksburg fault zone. Faulting originated from large scale gravity slumping on the shelf edge or slope. The fact that the fault strike was concave toward the basin was important in locating the structure.—*from* Author's abstract

03608 **Milne, V. G.** Manitouwadge area, Gemmell Township, District of Thunder Bay: Ontario Dept. Mines Prelim. Geol. Map P. 548, scale 1 in. to 800 feet, text, 1969.

Misharina, L. A. *See* Balakina, L. M. 03083

03541 **Mississippi Geological Survey.** Geologic map of Mississippi: [Jackson, Miss.] Mississippi Geol. Survey, scale 1:500,000, 1969.

03289 **Molola, R. J.; Clarke, R. T.; Phillips, B. J.** A rapid field method for making peels of unconsolidated sands: Geol. Soc. America Bull., v. 80, no. 7, p. 1385-1386, illus., 1969.

Elvacite 2044, an acrylic resin manufactured by DuPont, is an effective medium for making large or small peels of unconsolidated sands in the field. Drying time is approximately three hours, and even the finest sedimentary details are preserved. —Authors' abstract

03062 **Molenaar, C. M.** (compiler). Lexicon stratigraphic names used in northern Arizona and southern Utah east of the Paleozoic hinge line, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 68-77, 1969.

A lexicon is presented of stratigraphic names used in northern Arizona and southern Utah east of the Paleozoic hinge line (including metamorphic and igneous units in the Grand Canyon). In addition to the age of each rock unit listed, the following information is given: (1) areal distribution, (2) first reference in literature, (3) type locality, (4) generalized lithology and thickness, and (5) general information and depositional environment.—KAF

03481 **Molnar, Peter; Sykes, Lynn R.** Tectonics of the Caribbean and Middle America regions from focal mechanisms and seismicity: Geol. Soc. America Bull., v. 80, no. 9, p. 1639-1684, illus., tables, 1969.

Hypocenter determinations in the title area define the boundaries of two nearly aseismic plates of lithosphere: the Cocos plate, bordered by the East Pacific rise, the Galapagos rift zone, the Panama fracture zone, and the Middle America arc; and the Caribbean plate, bounded by the Middle America arc, the Cayman trough, the West Indies arc, and the seismic zone through northern South America. Focal mechanisms of 70 earthquakes in this region were determined to ascertain the relative motions of these two plates with respect to the surrounding regions or plates.—AG

Moore, Bruce. *See* Gauri, K. Lal. 03504

03148 **Moore, D. M.** B 2497.73 Å and line interference in the analysis of silicate-bearing rocks: Appl. Spectroscopy, v. 23, no. 3, p. 278-279, illus., table, 1969.

A different method for separating boron from SiO intensities at the 2497.73 A position is reported; attention is called to discrepancies in reports from competent observers concerning the nature of interference with B 2497.73 A. In analyzing 106 samples of a rock unit, chiefly shale with subordinate siltstone and limestone, SiO band peaks were compared with those of pure silica and pulverized quartz crystal; there was a slight deviation from the proportional intensity relations for the lines of the SiO band. More careful measurements of their positions and intensities plus careful evaluation of iron as an interfering element would increase precision and accuracy of boron measurement. Concentrations of boron in the 106 samples range from 1-520 ppm with a mean value of 187 ppm, compared with range of 1.5-2.8 ppm for G-1 and recommended mean value of 17 ppm for W-1.—GDC

03634 **Moore, Jay.** Stateline, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 127-130, illus., 1969.

Moore, R. C. *See* Brooks, H. K. 03492

03385 **Moore, Raymond C.; McCormick, Lavon.** General features of Crustacea, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R57-R120, illus., table, 1969.

This chapter is a comparative survey of the general nature of crustaceans, based mainly on extant forms. Crustacea are prevailingly aquatic arthropods characterized by two pairs of antennae on the head and by biramous limbs. Diversity of 22 crustacean groups is demonstrated by extant forms. General morphology is treated comparatively under the main body parts, with comprehensive glossary of terms. Ontogeny, regeneration of parts, and adaptations to environments and modes of life, as parasitism, are discussed. The Treatise classification outline shows suprageneric taxa, each with number of included genera and geologic age range. Crustacea are divided into 9 classes, of which 5 have fossil records.—VMJ

03389 **Moore, Raymond C.** Euthycarcinoidea, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R196-R199, illus., 1969.

The crustacean class Euthycarcinoidea Gall and Grauvogel, 1964, were originally interpreted as archaic copepods (Handlirsch, 1914); they also have some characteristics of merostomate chelicerates and diplopodan myriapods. Two similar monotypic genera, *Euthycarcinus* and *Sinaustrus*, from the Triassic of western Europe and Australia, were apparently mud-eaters. The elongate body averages 40 mm in length. The semicircular, flattened head, of fused somites, has annexed to it the first thoracic somite-bearing maxillipeds. The thorax has 11 more somites with uniramous limbs, covered by five dorsal tergites. The abdomen has five limbless somites and a long telson. Well-preserved, very small juveniles, molts, and adults with brood sacs are found.—VMJ

03467 **Moorhouse, W. W.** Memorial of Elwood S. Moore—August 3, 1879-March 26, 1966: Am. Mineralogist, v. 54, nos. 3-4, p. 634-638, portrait, 1969.

03338 **Moran, Joseph M.; Bryson, Reid A.** The contribution of Laurentide ice wastage to the eustatic rise of sea level, 10,000 to 6,000 BP: Arctic and Alpine Research, v. 1, no. 2, p. 97-104, illus., tables, 1969.

The contribution of the wasting Laurentide Ice Sheet to eustatic sea-level rise between 10,000 and 6,000 BP was estimated. Volumetric models were constructed on the basis of the present Greenland profile and past areal distributions of ice as delineated by the radiocarbon isochrone map of Bryson and Wendland. It was found that even with the assumption of negligible ice in the Arctic Archipelago, the Laurentide sheet was by far the major contributor to sea-level rise. A double-dome model resulted in a eustatic sea-level curve which conforms quite well with those derived in other independent studies.—Authors' abstract

03545 **Morgan, Charles O.; McNellis, Jesse M.; Lowell, Brent H.** Computer applications in hydrology in Kansas, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 3-7, illus., tables, 1969.

The U.S. Geological Survey, in cooperation with the State Geological Survey of Kansas since 1963 has been establishing a data-processing system, including storage and retrieval, for hydrologic data; it contains thousands of well-inventory, water-quality, water-level, and lithologic-log records. Accuracy is assured through a system that begins with coded forms, includes computer programs that check for logic errors, and ends with manual proofing of computer output. Numerous programs that manipulate and analyze data from the bank have enhanced the interpretive capability of a hydrologist. Methods of examining data, not practicable before the computer, are now feasible. Computer use has encouraged development of new analytic techniques and adaptation of methods from other fields. Using a high-speed digital computer, specific tasks can be done, achieving higher quality in less time and at lower cost.—*from* Authors' abstract

03151 **Moss, Melvin L.** Evolution of Mammalian dental enamel: Am. Mus. Novitates, no. 2360, 39 p., illus., 1969.

A polarizing microscope was used to study the evolutionary changes in mammalian dental enamel structure. Fossil and Recent teeth were studied. Data show that the enamel of the earliest true mammals was non-prismatic (continuous), that (1) true prismatic (discontinuous) enamel structure first arose in the early Cretaceous (Albian) therians, (2) in placentals prismatic enamel only gradually became the predominant structural type, and (3) nontherians did not evolve prismatic structure at any time.—KAF

03486 **Moussa, Mounir T.** Green River Formation (Eocene) in the Soldier Summit area, Utah: Geol. Soc. America Bull., v. 80, no. 9, p. 1737-1748, tables, 1969.

A section in the Soldier Summit area consists, in ascending order, of: Middle Fork Tongue of Green River Formation; Tabbyune Creek Tongue of Colton Formation; Soldier Summit, delta facies, Parachute Creek and Evacuation Creek Members of Green River Formation. The Middle Fork Tongue (250 to 280 feet) and Soldier Summit Member (460 feet) consist mainly of paper shale. The delta facies, about 3,250 feet thick, is predominantly marlstone. The Parachute Creek Member (630 feet) consists mostly of paper shale; the upper two tuff beds were correlated with Dane's tuff zone of the Parachute Creek. The Evacuation Creek Member (970 feet) consists of shale, marlstone, limestone and claystone that contain "salt" crystal molds; four tuff beds are correlated with Dane's upper tuff zone.—*from* Author's abstract

Mrose, Mary E. *See* Richmond, W. E. 03511

03432 **Muller, Olaf; Roy, Rustum.** A crystal-chemical study of some new rare earth-rhenium oxides: Materials Research Bull., v. 4, no. 6, p. 349-360, tables, 1969.

Several Ln_2O_3-ReO_3 systems (Ln = Nd, Sm, Gd, Dy, Er, Yb and Y) have been studied. New phases have been found and are characterized crystal-chemically. Tetragonal phases of the types Ln_3ReO_5 and $Ln_3ReO_{5.25}$ are described where Ln = Nd, Sm, and Gd. Other compounds near the Ln_2ReO_5 stoichiometry (Ln = Gd, Dy, Er, Yb, and Y) appear to be monoclinic. In three systems (Ln = Dy, Er, Y) fluorite-like phases have been found. Magnetic susceptibility measurements were carried out for several of the new phases. All were found to be paramagnetic within the temperature range investigated (77° to 373°K).—Authors' abstract

03279 **Mulligan, R.; Taylor, F. C.** Geology, Hill Island Lake, District of Mackenzie: Canada Geol. Survey Map 1203A, scale 1:253,440, text, 1969.

The Hill Island Lake area has been glaciated by an ice-sheet moving west-southwest; evidence of glacial action includes striae, ice polish, and friction cracks. Eskers and accompanying outwash deposits are present chiefly in the eastern part. Underlying rocks are Precambrian gneiss, granite, granodiorite, syenite, amphibolite, schist, porphyry, Tazin Group (quartzite, schist), Nonacho Group (conglomerate, arkose, quartzite), and aphanitic to brecciated rock. Diabase dikes are present in only a few places. Divergent trends in the Tazin-type rocks and derived gneisses suggest relict plunging-fold structures, but these rocks have been intensely deformed and dip mostly at high angles. No mineral deposits of economic importance are known.—MCM

03592 **Murata, K. J.; Friedman, Irving; Madsen, Beth M.** Isotopic composition of diagenetic carbonates in marine Miocene formations of California and Oregon: U.S. Geol. Survey Prof. Paper 614-B, p. B1-B24, illus., tables, 1969.

Diagenetic carbonates can be divided isotopically into a heavy-carbon group (δC-13 of +5 to +21 per mil relative to PDB standard) and a light-carbon group (δC-13 of -1 to -25 per mil). They were formed by primary calcite of Foraminifera and other fossils (δC-13 of 0 ± 4 per mil) in consolidated sediments being dissolved and redeposited along favorable horizons. The interstitial solutions involved contained carbonate ion, methane, and other products of decomposition of organic matter. The δC-13 of the deposited carbonate was heavier or lighter than that of the original fossils depending on whether or not isotopic equilibrium prevailed between carbonate ion and methane. The oxygen isotopic composition of diagenetic carbonates is virtually the same as that of normal marine carbonate (δO-18 of 26 to 34 per mil relative to standard mean ocean water).—KJM

Murphy, M. A. *See* Johnson, J. G. 03284

Musich, Lillian. *See* Newman, Walter S. 03582

Mutschler, Felix E. *See* Obradovich, John D. 03456

03139 **Myers, William E.** An investigation into the relationship between vegetation and geological formations [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 13, 1969.

03602 **Narasimhan, T. N.** Methods of analysis of pumping test data: Ground Water, v. 7, no. 2, p. 2-6, 1969.

For a quantitative knowledge of most hydrogeologic problems, it is necessary to know the aquifer properties. Leading methods for their determination involve pumping tests, the aquifer properties being computed from the cone of depression. Several methods for this are described including unsteady conditions of flow, partially penetrating wells, bounded aquifers, leaky aquifers, water table aquifers, anisotropic aquifers, multiaquifer wells, variable discharge, large diameter well, and ratio method.—ESL

03336 **Nason, Robert D.** Preliminary instrumental measurements of fault creep slippage on the San Andreas fault, California: Earthquake Notes, v. 40, no. 1, p. 6-10, illus., 1969.

Recent studies have delineated the occurrence of fault creep slippage on the San Andreas, Hayward, and Calaveras faults in central California. Preliminary instrumental measurements show that fault creep has different time character at different sites, being eventful at some places and continuous at others. Creep events measured at two sites indicate creep propagation rate of the order of 10 km per day.—Author's abstract

03526 **National Petroleum Council; Brockett, E. D.; Hedberg, Hollis D.** (committee chairmen). Petroleum resources under the ocean floor: Washington, D.C., Natl. Petroleum Council, 107 p., illus., tables, 1969.

Chapter headings are: summary and recommendations, U.S. energy requirements and national objectives, prospects of petroleum accumulations under the oceans, technological capability of industry for petroleum development of offshore areas, economics of offshore petroleum exploration and development, current national jurisdiction over petroleum resources of oceanic areas, implementation of U.S. policy objectives consistent with the 1958 Convention on the Continental Shelf, regime over oceanic areas beyond limits of exclusive national resources jurisdiction, relations between the petroleum industry and other users of oceans and seabeds, pollution control, conservation, and research.—MCM

03527 **Nave, Floyd K.** Pleistocene Mollusca of southwestern Ohio: Sterkiana, no. 34, 48 p., illus., tables, 1969.

Sixty-two species of Pleistocene mollusks from three postglacial lake deposits and one interstadial silt deposit are described and discussed. The most common species of the Clark and Champaign lacustrine deposits are typical for the assemblage, whereas those of the Greene lacustrine deposits are considered from a low, swampy area which experienced minor changes in environment. The Hamilton interstadial deposits contain mollusks and considerable plant debris. Freshwater and terrestrial mollusks were present in almost all deposits and are characteristic of a more northerly latitude. They were forced into Kentucky during maximum advance and have migrated northward since retreat. Observations in northern Kentucky confirm this hypothesis as do distributions of modern mollusks northward to Ontario.—*from* Author's abstract

03400 **Nelson, Gareth J.** The problem of historical biogeography: Systematic Zoology, v. 18, no. 2, p. 243-246, illus., 1969.

Few branches of science have included more controversy than biogeography. Theories of past geological events often have had such appeal that biogeographers lined up behind one or another (e.g., continental drift) in interpreting their data. Speciation normally involves splitting of an ancestral population into geographically isolated daughter populations. If evidence is available to suggest a relationship between distributions of some fossil and Recent species, a common ancestor is assumed, but this cannot be demonstrated. Four confusing hypotheses of origin and distribution point out the need for better understanding of phylogenetic relationships and survival of ancient forms in response to factors of the environment.—GDC

Nelson, Samuel J. *See* Johnson, Ronald D. 02973

03635 **Nesbit, Robert A.** Worsham-Bayer, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 131-134, illus., 1969.

03647 **Newby, Jerry B.** Hubert E. Bale, 1898-1969: Shale Shaker, v. 19, no. 10, p. 182, portrait, 1969.

03593 **Newcomb, R. C.** Effect of tectonic structure on the occurrence of ground water in the basalt of the Columbia River Group of The Dalles area, Oregon and Washington: U.S. Geol. Survey Prof. Paper 383-C, p. C1-C33, illus., geol. map, 1969.

In basalts of the Columbia River Group, inclination of aquifers increases infiltration and vertical transfer and vertical and lateral percolation of ground water. Structural

barriers to lateral percolation occur where underlying impermeable strata rise in an anticline, faults destroy or offset permeable layers, or where combinations of these occur. Examples of structural barriers are cited. In some cases hydrologic features can indicate geologic structure. Understanding of the close relation between structure and occurrence of ground water can be used for better predictions of drilling results. An accurate geologic map is imperative for interpretation of water occurrences.—VSN

03582 **Newman, Walter S.; Thurber, David H.; Zeiss, Harvey S.; Rokach, Allan; Musich, Lillian.** Late Quaternary geology of the Hudson River estuary—A preliminary report: New York Acad. Sci. Trans., ser. 2, v. 31, no. 5, p. 548-569, illus., 1969.

The Hudson River valley's reversed bedrock thalweg from Newburgh to the Narrows proves it to be the world's lowest latitude fjord. The Hudson Valley's alinement was cut during the Tertiary but was modified and overdeepened by glacial processes. The valley fill of lacustrine sediments and fluvial sand and gravel is described; very little till is present. Sediments contain palynomorphs, diatoms, foraminifera, and mollusks. The valley has been an estuary since 12,000 B.P., and there is evidence of crustal subsidence following glacial rebound. Radiocarbon dates pertinent to Hudson River chronology are charted.—ESL

03491 **Newman, William A.; Zullo, Victor A.; Withers, T. H.** Cirripedia, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R206-R295, illus., tables, 1969; addendum, ibid., V. 2, p. R628-R629, 1969.

The class Cirripedia comprise a diverse and conspicuous group of sedentary marine crustaceans which become attached by the first antennae during the cyprid larval stage; the bivalved cyprid carapace is homologous with the adult mantle, which encloses the appendage-bearing parts of the body. Only the order Thoracica (Silurian-Holocene, 72 genera, 29 subgenera) are represented by body fossils, calcareous plates covering the mantle. The free-living Acrothoracica (Carboniferous-Holocene) are represented by burrows in the shells; the parasitic Ascothoracica (Cretaceous-Holocene) by holes and cysts; the parasitic Rhizocephala have no fossil record. Cirripeds seem to have closest affinities with copepods and branchiurans. Morphology of Thoracica, study techniques, and phylogeny are discussed at length.—VMJ

Newton, Geoffrey B. *See* Driscoll, Egbert G. 02995

03571 **Niazi, Mansour.** Shallow earthquakes and surface faulting in northern California and Iran, *in* CENTO conference on earthquake hazard minimization, Ankara, 1968: Ankara, Turkey, U.S. Econ. Coordinator CENTO Affairs, p. 139-147, illus., 1969.

Illustrations have been prepared to examine the spatial distribution of the largest earthquakes of a region, within a period, in relation to the existing fault systems. One illustration shows that in northern California and western Nevada, in general, the seismic activity is concentrated in regions of extensive faulting. An exception is the almost north-south trending Melones Fault System along the eastern margin of the Great Valley. The correspondence of the large earthquakes of the last 10 years and the mapped surface faults in Iran does not appear as good as the data for California. Most of the seismic activity has taken place along the Zagros Mountains in western and southern Iran.—KAF

Nichols, T. C., Jr. *See* Wahlstrom, Ernest E. 03654

Noland, Anne V. *See* Gauri, K. Lal. 03504

03276 **Norford, B. S.** Ordovician and Silurian stratigraphy of the southern Rocky Mountains [with French abs.]: Canada Geol. Survey Bull. 176, 90 p., illus., geol. map, 1969.

Upper Ordovician and Lower Silurian platform carbonates covered this area. Middle Ordovician deposits are similar in the eastern part, but miogeosynclinal shales and

limestones appear toward the southwest, with the facies change just within British Columbia. Devonian rocks rest unconformably on Precambrian to Lower Silurian strata; in the west, the Middle Devonian overlies Lower Silurian beds; in the east, local deposits of Early to Late Devonian age overlie Upper Ordovician. Stratigraphic nomenclature is revised for Middle and Upper Ordovician and Silurian units: Beaverfoot Formation is restricted and Wonah Quartzite and Brisco Formations are considered obsolete. Proposed new unit names are: Ordovician—Tipperary Quartzite, Owen Creek Formation, and Whiskey Trail Member of the Beaverfoot; Silurian—Tegart Formation. Faunal zones are recognized in Bearfoot and Skoki Formations.—GDC

03589 **Norford, B. S.; Steele, H. Miriam.** The Ordovician trimerellid brachiopod *Eodinobolus* from south-east Ontario: Palaeontology, v. 12, pt. 1, p. 161-171, illus., 1969.

Obolus canadensis Billings, *Obolellina magnifica* Billings, and *Dinobolus erectus* Wilson are redescribed. The species are Wilderness (early Caradoc) in age. Rowell recently assigned all three species to *Eodinobolus* and chose *Obolellina magnifica* as the type species. The internal structures of the three species are described from silicified material. A hypothesis is presented for the mechanics of the opening and closing of the shell and requires articulation about a poorly defined hinge that is analogous in its position to that of the Class Articulata.—Authors' abstract

03498 **Normark, W. E.; Piper, D. J. W.** Deep-sea fan-valleys, past and present: Geol. Soc. America Bull., v. 80, no. 9, p. 1859-1866, illus., 1969.

The development of deep-sea fan-valleys and the processes leading to their eventual filling have been studied through detailed comparison of two contemporary fan-valleys with one of Miocene age now exposed on land. Results from narrow-beam near-bottom echo soundings and seismic reflection profiles were coordinated with information from bottom sampling on La Jolla and San Lucas Fans, off southern California and Baja California respectively. A Miocene fan-valley exposed in sea cliffs near Dana Point, southern California, was used for comparison. In all three cases, a fan-valley has been cut into horizontally bedded muds and silts of the surrounding fan. Terraces form on resistant horizons cropping out on the valley walls. Irregularly bedded sands with mudlumps and conglomerates in some sections fill the main parts of channels.—*from* Authors' abstract

Norris, A. W. *See* Hood, Peter J. 02963

02971 **Norris, A. W.; Sanford, B. V.** Paleozoic and Mesozoic geology of the Hudson Bay Lowlands, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 169-205, illus., 1969.

Two major Phanerozoic sedimentary basins are present in the Hudson Bay Lowlands, the Moose River basin in the south and the Hudson Bay basin in the north. The basins are separated by the Cape Henrietta Arch, where Archean and Proterozoic rocks are exposed in inliers surrounded by a thin veneer of Silurian rocks. In the Moose River basin, Ordovician, Silurian, Devonian and Lower Cretaceous rocks are present (2,500 feet thick in the central part of the basin), and in the Hudson Bay basin rocks of Ordovician, Silurian and Devonian age (6,000 feet thick in the central part of the basin) are represented on the mainland.—KAF

03178 **Northcote, Kenneth Eugene.** Geology and geochronology of the Guichon Creek batholith, B. C. [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3792B-3793B, 1969.

03160 **Nowak, Michael.** Archeological dating by means of volcanic ash strata [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3598B-3599B, 1969.

03333 **Nur, Amos.** The effect of fluid-filled pores on seismic velocities of rocks [abs.]: Earthquake Notes, v. 40, no. 1, p. 24, 1969.

03456 **Obradovich, John D.; Mutschler, Felix E.; Bryant, Bruce.** Potassium-argon ages bearing on the igneous and tectonic history of the Elk Mountains and vicinity, Colorado—A preliminary report: Geol. Soc. America Bull., v. 80, no. 9, p. 1749-1756, illus., table, 1969.

K-Ar ages of 11 biotites and one muscovite separated from epizonal plutonic rocks in the Elk Mountains and vicinity, range from 72 m.y. to 12.5 m.y. Igneous chronology is correlated with the field relations to give the following sequence of geologic events: (1) uplift of Sawatch Range, (2) gravity sliding of sediments along the Elk Range thrust fault, (3) intrusion of granodiorite (Oligocene), (4) emplacement of mafic dikes (Miocene and Pliocene,), and (5) intrusion of soda granite.—AH

03584 **O'Brien, Neal R.; Harrison, William.** Fabric of a non-fissile Pleistocene clay: Naturwissenschaften, v. 56, no. 3, p. 135-136, illus., 1969.

The paper presents an electron micrograph showing the fabric of a sensitive clay, which outcrops in the St. Lawrence Valley near Massena, New York. Randomly oriented clay flakes, similar to the Oslo Blue clay, are displayed. One group of flakes suggests deposition in the flocculated stage. The micrograph supports the cardhouse model advanced for clays of this type. There is an obvious correlation between the non-fissile character and the high degree of random clay flake orientation.—ESL

Odom, A. L. *See* Anderson, Jay Earl, Jr. 03507

Ohrbom, Richard. *See* Hsü, K. Jinghwa. 03085

03314 **Oliver, Jack.** Earthquakes in New York State: Conservationist, v. 23, no. 5, p. 6-9, illus., 1969.

On November 22, 1967, a mild earthquake occurred in Westchester County. New York State has experienced earthquake activity in the past, and probably will continue to experience it. As the area is built up more, earthquake countermeasures must be based on evaluation of information in three categories: historical record of seismic activity, basic understanding of earthquakes and their causes, and the geologic record. Records of earthquakes in the United States and the northeastern states are shown on maps. The seismic history of New York is reviewed; zones of weakness in the State include Logan's fault. Expanded observation is needed to obtain information for future planning.—ESL

Oro, J. *See* Flory, D. A. 03655

03179 **Orr, William Norton.** The distribution of planktonic Foraminifera in the northwest Gulf of Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3793B, 1969.

03076 **Overton, A.** An alternative interpretation of the 1965 Hudson Bay crustal seismic data, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 292-306, illus., 1969.

Results of three time-term interpretations of the 1965 Hudson Bay crustal seismic data are compared and reasons for discrepancies are discussed. An independent determination of relative structure on the upper mantle has been made for that portion of the profile under the shotpoints of the east-west profile between the Ottawa Islands and Churchill. A comparison of the proposed structure with that derived from the time-term solution demonstrates that the relative crustal thinning beneath the eastern end of the profile is due to errors in shot position or to an inconsistency in upper mantle velocity. Derivation of this structure also demonstrates other sources of error. An objective method for selecting combinations of data which are mutually consistent with a system of unique time-terms and upper mantle velocity is suggested.—*from* Author's abstract

03500 **Page, Robert.** Late Cenozoic movement on the Fairweather fault in southeastern Alaska: Geol. Soc. America Bull., v. 80, no. 9, p. 1873-1877, illus., 1969.

A tentative history of late Cenozoic displacement on the Fairweather fault is presented. Geomorphic observations suggest predominantly dextral strike-slip movement at a rate of a few centimeters per year for at least the last millenium. The associated dip-slip component of motion is several times smaller than the strike-slip component. Little variation in the rate and the nature of displacement on the Fairweather fault from early Pliocene time to the present is consistent with interpretations of sea-floor spreading in the North Pacific Ocean.—Author's abstract

03489 **Palmer, A. R.** Copepoda, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R200-R203, illus., 1969.

Copepods are small crustaceans, < 5 mm, found in nearly all aquatic environments as numerous extant free-living and parasitic species. The classification of Sars (1901-03) recognizes three orders of free-living forms—the planktonic Calanoida and Cyclopoida and the benthonic Harpacticoida—and four orders of parasitic or commensal forms (not treated here). Only free-living forms have been found as fossils. The elongate, subcylindrical, segmented body is characteristically divided into prosome and urosome by a prominent movable articulation between four or five anterior and one or two posterior thoracic somites. A cyclopoid genus and two species of the harpacticoid *Cletocamptus* have been found in Miocene lake beds of California, associated with boron minerals.—VMJ

03335 **Pararas-Carayannis, George.** Epicenter determination by use of numerically calculated travel-time differences: Earthquake Notes, v. 40, no. 1, p. 11-17, illus., 1969.

A spherical hyperbola program initially used for the determination of T-phase origins has been modified to allow the determination of earthquake epicenters by use of time differences in P-wave travel. Theoretical P-wave traveltime differences for pairs of seismic stations have been calculated and plotted on charts by a digital computer utilizing data from the Jeffreys-Bullen tables. The epicenter determination is accomplished in the following manner: If three stations observe an event, then the three different P-wave arrival times give two independent traveltime difference values (Δt). Each Δt value determines a time difference curve. The intersection of the two time-difference curves determines the epicenter location.—Author's abstract

03649 **Pariseau, William G.** The post-yield flexure of geologic strata: Soc. Mining Engineers Trans., v. 244, no. 2, p. 203-209, tables, 1969.

The flexure of geologic strata, a phenomenon of interest to geologists and mining engineers alike, is examined as a sheet bending problem in Coulomb plasticity. Formulae for the distribution of stress, strain, and displacement increments; volume change; change in the length of the central surface; and power of dissipation, as well as for the neutral surface shift are given. Strains of any magnitude are considered. The analysis shows that deeply buried strata may bend and develop "tensile" cracks under generally compressive states of stress. It is also shown that bed separation and high capacity props are desirable in mechanized longwall mining, a result in keeping with operating experience. Although speculative at this time the analysis provides a rational working hypothesis as regards the problem of strata flexure and control.—Author's abstract

03618 **Parrish, James H.** Gomez (Ellenburger), *in* Oil and gas fields in West Texas—Symposium, V.2: West Texas Geol. Soc. Pub. 69-57, p. 57-60, illus., 1969.

02987 **Patton, Thomas H.** An Oligocene land vertebrate fauna from Florida: Jour. Paleontology, v. 43, no. 2, p. 543-546, illus., 1969.

A late Oligocene (Whitneyan) fauna near Gainesville, the oldest extensive Cenozoic land vertebrate fauna in eastern North America, includes: Chondrichthyes and Osteichythyes (possibly reworked), Amphibia (Anura, Urodela), Reptilia (Testudinata, Lacertilia, Serpentes), assorted bird bones, and Mammalia (Didelphidae, Soricoidea, Chiroptera, Leporidae, Cricetidae, Eomyidae, Heteromyidae, ?Eutypomyidae, *?Daphoenus*, *?Paleogale*, *Mesohippus*, Tayassuidae, Oreodonta, ?Protoceratidae). All the mammalian genera are new to eastern U.S. It is suggested

that faunal connections between Florida and other biotic provinces, especially the Great Plains, were at times relatively open. The diversified fauna indicates extensive occupation of the region for a considerable time.—FCW

Peacor, Donald R. *See* Freed, R. L. 03343

Pecora, W. T. *See* Federal Council Sci. and Technology. 03572

Pelletier, B. R. *See* Hood, Peter J. 02963

02968 **Pelletier, B. R.** Submarine physiography, bottom sediments, and models of sediment transport in Hudson Bay, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 100-135, illus., 1969.

Chief control of submarine physiography in Hudson Bay is bedrock structure and lithology and secondarily, pre-Pleistocene subaerial erosion. Regularity of concentric bottom contours is disrupted by the radial pattern of an apparently submerged trunk system and a few major troughs and ridges. Models of sedimentary transport, based on lithological ratios, topographic depth zones, and agents of sedimentary transport show the influence of ice rafting over all energy zones and topographic environments. By removing the ice-rafted debris, a recalculated plot of the lithologic ratios in relationship to the energy zones shows the dispersal pattern of the sediment to approximate that found on a hypothetical sea floor underlying zones of similar hydrodynamic vigour.—KAF

Perry, T. G. *See* Anstey, Robert L. 03003

Pessagno, E. A., Jr. *See* Burk, C. A. 03107

03426 **Peterson, M. N. A.; Edgar, N. T.** Deep ocean drilling with GLOMAR CHALLENGER: Oceans, v. 1, no. 5, p. 17-32, illus., 1969.

To answer questions as to the origin of ocean basins, their age, and history, the Deep Sea Drilling Project for coring sediments and rocks in the basins is being carried out on board the *Glomar Challenger*, guided by 20 to 30 years of geophysical surveys. Data from all studies will make it possible to reconstruct crustal history. The question of where to drill was settled by site surveys. Some of the outstanding discoveries include: oil-saturated cap rock on one of the Sigsbee Knolls, Gulf of Mexico; Jurassic rocks near the island of San Salvador, Bahamas; basalt basement below sediments in cores taken across the Mid-Atlantic Ridge; and, in the sediments, a wide-spread chert bed of Eocene age. Sediments can be divided into those composed mostly of shells, and the gray to reddish-brown clays at greater depths.—ESL

Phillips, B. J. *See* Moiola, R. J. 03289

03629 **Phipps, R. V.** North Riley, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 109-111, illus., 1969.

03630 **Phipps, R. V.** North Robertson (Clear Fork 7100), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 110, 112-113, illus., 1969.

03632 **Phipps, R. V.** Smyer (Clear Fork), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 118-121, illus., 1969.

03633 **Phipps, R. V.** North Smyer (Canyon, Strawn), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 122-126, illus., 1969.

03626 **Phipps, Robert V.** Landon (San Andres, Devonian), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 93-96, illus., 1969.

03464 **Pierce, William G.** Memorial of David Gallagher—May 4, 1906-February 8, 1968: Am. Mineralogist, v. 54, nos. 3-4, p. 615-619, portrait, 1969.

03361 **Pincus, H. J.** Sensitivity of optical data processing to changes in rock fabric—Pt. 1, Geometric patterns: Internat. Jour. Rock Mechanics and Mining Sci., v. 6, no. 3, p. 259-268, illus., tables, 1969.

Idealized geometric patterns have been used as input test data to determine the sensitivity of optical data processing to changes in fabric. Useful test results have been obtained for separating input components of different directions or different spatial frequencies, measuring elongation of simulated grains and determining their stacking geometry, and filtering for band-pass and high-cut outputs. All of the operations performed here and the results obtained are directly transferable to rock fabric inputs. —Author's abstract

03362 **Pincus, H. J.** Sensitivity of optical data processing to changes in rock fabric—Pt. 2, Standardized grain patterns: Internat. Jour. Rock Mechanics and Mining Sci., v. 6, no. 3, p. 269-272, illus., tables, 1969.

Standardized grain patterns have been used as input test data to evaluate the sensitivity of optical data processing to changes in fabric. Differences in grain size for untwinned, flat etch inputs and twinned, contrast etch inputs can be detected between successive members in two ASTM standard series. When applied to half-tone inputs, the maximum spatial frequencies of ODP inputs should not be larger than one-fifth the spatial frequency of the half-tone screen.—Author's abstract

03363 **Pincus, H. J.** Sensitivity of optical data processing to changes in rock fabric—Pt. 3, Rock fabrics: Internat. Jour. Rock Mechanics and Mining Sci., v. 6, no. 3, p. 273-276, illus., table, 1969.

ODP can detect fine, subparallel fractures developed in experimentally deformed rocks. Some characteristics of fracture sets can be inferred from their transforms. With suitable precautions, photographs of curved as well as of plane surfaces of rocks can be used as inputs. When fracture propagation involves only minor changes in direction and spatial frequency, the associated changes in transforms are significant. Inputs consisting of tracings of photomicrographs can be processed with results comparable to those obtained directly from photomicrographs.—Author's abstract

03298 **Pings, W. B.** The rare earths today: Colorado School Mines Mineral Industries Bull., v. 12, no. 2, 19 p., illus., tables, 1969.

The rare earth industry with its ever-increasing commercial significance and methods of extraction of rare earths are reviewed. The beginning of rare earth history was in 1794, when a new earth was found in a mineral discovered six years earlier by Arrhenius at Ytterby, Sweden; the original yttria was a mixture of 15 or 16 different metal oxides. The chronology of discoveries, and the abundance of rare earths and other metals, and properties of rare earths, are tabulated. Monazite, a rare-earth phosphate, was at first the only common mineral source of thorium; its content of rare-earth elements is listed and it is noted that cerium forms about 46 percent. Sources of several types of rare-earth minerals are given. Uses of rare earths and compounds are listed and present and proposed applications are discussed.—GDC

Piper, D. J. W. *See* Normark, W. E. 03498

Pitcher, Max G. *See* Griffith, L. S. 03515

Pitman, W. C., 3d. *See* Fox, Paul J. 03587

Plusquellec, Paul L. *See* Sandberg, Philip A. 02992

03345 **Poag, C. Wylie.** Dissolution of molluscan calcite by the attached foraminifer *Vasiglobulina*, new genus (Vasiglobulininae, new subfamily): Tulane Studies Geology and Paleontology, v. 7, no. 2, p. 45-72, illus., 1969.

The new foraminiferal genus *Vasiglobulina* comprises polymorphine species which possess an apertural system of hollow tubules radiating outward from the distal end of the final chamber lumen to the exterior surface of the test. The type species,

Vasiglobulina alabamensis (Cushman and McGlamery), occurs in Gulf Coast sedimentary rocks which were deposited under shallow marine conditions during the upper Eocene to lower Miocene Epochs. It is ornamented by exterior spines which penetrate mollusc fragments, establishing a unique mode of permanent epifaunal attachment. These unusual morphological features furnish the bases for significant paleoecological and functional interferences. Five previously described species from Gulf Coast and European Tertiary localities are assigned to *Vasiglobulina*, establishing its known geologic range as upper Eocene to Pliocene.—Author's abstract

Poindexter, Edward H. *See* Cloke, Paul L. 03463

03060 **Pollack, Henry N.** A numerical model of Grand Canyon, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 61-62, illus., 1969.

A numerical model of fluvial erosion and valley widening in strata of varying resistance has been developed with application to the sculpturing of the Grand Canyon.—KAF

03010 **Pollock, Charles A.** Fused conodont clusters from Indiana: Jour. Paleontology, v. 43, no. 4, p. 929-935, illus., 1969.

Fused clusters representing portions of natural conodont assemblages of late Middle to early Late Silurian age were found in northern Indiana in the Kokomo Limestone Member of the Salina Formation 30 and 50 ft above the Salomonie Dolomite, and in the Liston Creek Limestone and Mississinewa Shale Members of the Wabash Formation. The genera *Spathognathodus*, *Ligonodina*, *Panderodus*, *Trichonodella*, and *Ozarkodina* are found in single taxon clusters, and *Spathognathodus*, *Trichonodella*, *Ozarkodina*, *Hindeodella*, *Neoprioniodus*, and *Synprioniodina* as multitaxon clusters. Two natural conodont associations are evident: those associated with *Spathognathodus* and those with *Trichonodella*.—*from* Author's abstract

03022 **Poplin, Jack Kenneth.** A model study of dynamically loaded square footings on dry sand [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4160B-4161B, 1969.

03302 **Powell, W. J.; LaMoreaux, P. E.** A problem of subsidence in a limestone terrane at Columbiana, Alabama: Alabama Geol. Survey Circ. 56, 30 p., illus., 1969.

Cracks appeared in walls of some buildings as early as 1967, and began to widen in 1968. A hole 25 by 20 feet, and 20 feet deep formed, and revealed a cavern about 5 feet in diameter. The principal source of water is solution openings in the Newala Limestone which underlies Waxahatchee Slate and Floyd Shale. Subsidence is also adjacent to the trace of the Wilsonville fault. Suggestions for alleviating future subsidence are: discontinue pumping from wells in subsidence area; fill in depressions, sinkholes, and surface cracks; dismantle the water tower, which is leaning; make a detailed study of the zone above bedrock and a profile of the surface of the Newala Limestone; and plan for measuring and recording ground-water levels in the area of subsidence. A program of study of Kewahatchie Spring, site of a new well field, should be started.—ESL

03406 **Power, Dean V.** Analysis of Earth motions and seismic sources by power spectral density: Seismol. Soc. America Bull., v. 59, no. 3, p. 1071-1091, illus., tables, 1969.

Ground motion records from six high-explosive cratering events in northeastern Montana, 10 contained nuclear explosive events at the Nevada Test Site, and motions of an earth-fill dam during the Gasbuggy underground nuclear explosion in New Mexico were analyzed for power spectral density, peak velocity and velocity spectra. An increase in depth of burst resulted in an increase in peak velocities and power-spectral densities as measured at distant points (> 5 km). Power spectral density was approximately proportional to the first power of yield; for this region it varied inversely as radial distance to the 3.55 power. A significant shift in the frequency of the energy in the seismogram occurs when the source location changes. A method of

using power spectral density to measure earthquake magnitudes and the yield of underground explosions is proposed.—*from* Author's abstract

Praszker, Michael. *See* Lee, Charles H. 03074

03640 **Pratt, Walden P.; McKnight, Edwin T.; DeHon, Rene A.** Geologic map of the Rico quadrangle, Dolores and Montezuma Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-797, scale 1:24,000, sections, 1969.

03036 **Privett, Donald Ray.** Alkali reactivity and poor construction practices—Causes of deterioration of concrete bridges in central Tennessee [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4230B, 1969.

03374 **Psuty, Norbert P.; Bailey, James S.** Lagoons, islands, off-shore islands, shorelines and banks, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. G7-G14, illus. [1969?].

A Gemini photo of Laguna de Terminos, Campeche, Mexico, illustrates the complicated features created by fluvial deposition and wave action. A photo of the Jardines de la Reina Islands, Cuba, shows them to be remnants of a dissected Pleistocene reef. Offshore islands are illustrated by a photo of the Florida Keys and Bay. The Great Bahama Bank off Cuba shows the relation of land to reef flats and the large offshore bank.—ESL

Pulpan, Hans. *See* Gedney, Larry. 03422

03037 **Purdy, John Winston.** A rubidium-strontium and potassium-argon isotopic age investigation within the Superior Province of the Precambrian Canadian Shield [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4230B-4231B, 1969.

Quinterno, Paula. *See* McKelvey, V. E. 03513

03332 **Rabbitt, Mary C.** John Wesley Powell, his life and times: Geotimes, v. 14, no. 5, p. 10-12, illus., 1969.

Rabbitt, Mary C. *See* Craig, Gordon Y. 03349

03439 **Radwin, George E.** A Recent molluscan fauna from the Caribbean coast of southeastern Panama [with Spanish abs.]: San Diego Soc. Nat. History Trans., v. 15, no. 14, p. 229-236, illus., table, 1969.

This paper lists a Recent marine molluscan fauna from Payardi Island, Panama. Twenty-nine percent of these species have close relatives on the Pacific side of the isthmus. It is suggested that the term "cognate" be used to replace the presently used term "analogue" in referring to these closely related forms.—Author's abstract

03330 **Rahman, Md. Ataur; Smerdon, Ernest T.; Hiler, Edward A.** Effect of sediment concentration on well recharge in a fine sand aquifer: Water Resources Research, v. 5, no. 3, p. 641-646, tables, 1969.

A model recharge well was constructed to simulate recharge into wells in a fine sand aquifer. The sand had a uniformity coefficient of 1.25 and an effective diameter of 144 microns. Both tap water and sediment laden water were used for recharge. Sediment laden water was obtained by mixing 50 percent bentonite and 50 percent kaolinite with tap water. Sediment concentrations were 100, 200, and 500 ppm. The piezometric surfaces near the recharge well were measured during the tests. Migration of sediment into the aquifer was determined by sampling aquifer sand after tests at predetermined distances from the well. The sediment in the recharge water highly affected the rate of recharge. During the period of tests a reduction in hydraulic conductivity of the model aquifer of 15-46 percent occurred as a result of recharge with sediment laden water. Most sediment deposited in the aquifer was retained near the well screen.—*from* Authors' abstract

03272 **Rains, R. B.** Differentiation of till deposits in the Whitemud Creek valley, Edmonton, Alberta: Albertan Geographer, no. 5, p. 12-20, illus., tables, 1969.

Color differences mark two tills in the Whitemud Creek valley. Five of 20 gray exposures, in two of which brown also occur, were sampled for pebble orientation and mechanical analysis of fine-grained material. Diagrams illustrate the bed descriptions and fabric of till sections. It would appear from fabric that the brown and gray tills represent separate glacial phases: the lower gray, its pebbles definitely oriented NE-SW, is a lodgement deposit; the upper brown, with no visible orientation is an ablation moraine. In mechanical composition, higher clay percentage in gray samples might confirm the two-till hypothesis, but this small scale study can hardly elucidate the area's late Pleistocene history.—GDC

03371 **Raisz, Erwin.** Mapping landforms from space photos—The sunken craters of Potrillo, N. M. from G4-R3-20, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. E70, illus. [1969?].

This is one of a number of examples given, and consists of an index map of the Potrillo, N. Mex. area, a portion of a space photo, and a model of the area. The mountains are low volcanic hills, and shallow sharp-rimmed depressions are the most remarkable features of the area; they may have originated from a subcrustal rise followed by funnel-like sinking.—ESL

03292 **Ramsey, Edwin L.** Computer applications to geology [abs.]: Nebraska Acad. Sci. Proc., 79th Ann. Mtg., p. 27, 1969.

03045 **Randall, Michael John.** The radiation pattern of the long-period P-wave pulse—A measure of strain at the focus of deep earthquakes [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4234B, 1969.

Rao, A. P. *See* Kirkbright, G. F. 03512

Raven, Peter H. *See* Ehrlich, Paul R. 03534

03038 **Reams, Max Warren.** Cave sediments and the geomorphic history of the Ozarks [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4231B, 1969.

03091 **Reed, Kenneth J.** Environment of deposition of source beds of high-wax oil [Discussion of "Significance of high-wax oils with respect to genesis of petroleum" by H. D. Hedberg, 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1502-1506, illus., tables, 1969.

Hedberg's (ibid., v. 52, no. 5, p. 736-750, 1968) suggestion that high-wax oils may reflect the contribution of terrigenous organic material to the genesis of petroleum has been tested in 41 samples from offshore wells on the Niger River delta. Interpretations of the environment of deposition of the 41 samples on the basis of relative abundance of arenaceous and planktonic foraminifera and the total foraminiferal population supports the hypothesis in 34 (83 percent) of the 41 samples.—Author's abstract

Reid, Arch M. *See* Frazer, Jane Z. 03447

Reid, R. R. *See* Greenwood, W. R. 03472

03273 **Reinelt, E. R.** Geodynamic motion and the Coriolis force: Albertan Geographer, no. 5, p. 25-36, illus., 1969.

Inertial motion on the Earth is superficially similar to motion on a rotating sphere, but the spheroidal shape of the Earth, flattened at the poles and bulging at the equator, is the equilibrium shape a large spherical body would assume under rotation. The bulge prevents an inexorable drift toward the equator by counteracting the driving centrifugal force. Motions of bodies at various locations on Earth are considered, comparing inertial centrifugal, and Coriolis effects; also motions of the atmosphere,

comparing diagrams of a nonrotating and rotating Earth, and showing establishment of geostrophic balance with increasing Coriolis force.—GDC

03449 **Reynolds, Robert C., Jr.** Orientation of ethylene glycol monoethyl ether molecules on montmorillonite: Am. Mineralogist, v. 54, nos. 3-4, p. 562-567, tables, 1969.

A study of the intensities of basal reflections from ethylene glycol monoethyl ether-montmorillonite indicates that the plane of symmetry of the aliphatic chain lies perpendicular to the clay oxygen surface. The complex appears to contain two layers, each of which has one-half the molecular density of ethylene glycol layers on montmorillonite. The value $d(001) = 16.0$ A makes this complex potentially useful for identification of expandable and mixed-layered expandable clays in cases where line interference is encountered on diffractograms from glycol or glycerine treated samples.—Author's abstract

Ribbe, P. H. *See* Gibbs, G. V. 03474

Ribbe, P. H. *See* Jones, Norris W. 03475

03641 **Rice, Charles L.** Geologic map of the Ivyton quadrangle, eastern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-801, scale 1:24,000, section, text, 1969.

Principal resources of the Ivyton quadrangle are coal, gas, and oil. Coal has been mined from as many as ten coal beds primarily for domestic use. The quadrangle is within the Big Sandy gas field where gas is obtained from the Pennsylvanian Lee Formation, Mississippian Pennington Formation, Greenbrier Limestone, and Berea Sandstone, Devonian Ohio Shale, and Silurian dolomite and sandstone. Small quantities of oil are produced commercially from a southward extension of the Oil Springs pool, reportedly from the Mississippian "Weir" sandstone. Other resources include alluvial sand and gravel and shale.—MCM

Rice, G. Wesley. *See* Griffith, L. S. 03515

Richards, R. B. *See* Whittington, H. B. 03114

03115 **Richards, R. Peter; Shabica, Charles W.** Cylindrical living burrows in Ordovician dalmanellid brachiopod beds: Jour. Paleontology, v. 43, no. 3, p. 838-841, illus., 1969.

Abundant examples of cylindrical borings in the brachiopod *Onniella meeki* (Miller), of the sort previously thought to be the work of predatory gastropods, have been found in coquinas at Brookville, Ind. However, it now appears that boring occurred subsequent to deposition, for in some cases more than one *Onniella* valve in succession in the coquina is bored. Comparison of modern boring with the Ordovician ones suggests that the borings are parts of the living burrows of an unknown polychaete annelid which was a member of the same community as *Onniella*.—Authors' abstract

03511 **Richmond, W. E.; Fleischer, Michael; Mrose, Mary E.** Studies on manganese oxide minerals—[Pt.] 9, Rancieite [with French abs.]: Soc. Française Mineralogie et Cristallographie Bull., v. 92, no. 2, p. 191-195, illus., tables, 1969.

A chemical analysis, X-ray powder data, and a dehydration curve are given for rancieite from Oriente Province, Cuba, and new X-ray powder data are tabulated for samples from other localities. All available data on chemical composition, X-ray powder diffraction patterns, and dehydration studies for rancieite are summarized. New localities are listed. Rancieite is a valid species, but the data on chemical composition and the products formed when it is heated are inadequate.—Authors' abstract

03285 **Riddell, Francis A.** Pleistocene faunal remains associated with carbonaceous material: Am. Antiquity, v. 34, no. 2, p. 177-180, illus., 1969.

Features which have been interpreted as "fire hearths" and "charcoal" have been recorded in association with mammoth and other Pleistocene faunal remains. Some of these remains have been dated by the radiocarbon method as exceeding 10,000 yr; a few are considerably in excess of this. A review of some of these remains suggests the probability of noncultural origin for the carbonaceous material in question. Recent excavations in Merced and Orange Counties, Calif., have revealed Pleistocene faunal remains in direct association with an abundance of carbonaceous material. It can be demonstrated that these remains are noncultural in origin —Author's abstract

03039 **Rieder, Milan.** A study of natural and synthetic lithium-iron micas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4231B-4232B, 1969.

Riley, D. L. *See* Herzenberg, C. L. 03342

03327 **Riley, R. A.** Red Lake district, *in* Annual report of Resident Geologists' Section, Geological Branch, 1968, Pt. 1: Ontario Dept. Mines Misc. Paper 23, p. 1-15, illus., tables, 1969.

Mining activity in four producing mines and one new one, and underground exploration at another are reviewed. Information on three new areas and types of mineralization are given, and new maps and literature listed. The general and economic geology are described for two mines; and recommendations are made for future exploration.—ESL

03322 **Rives, John S.** Prospecting in the Trinity and Nuevo Leon Groups—An exploration philosophy [abs.]: South Texas Geol. Soc. Bull., v. 9, no. 9, p. 3-4, 1969.

03402 **Robeck, Gordon G.** Microbial problems in ground water: Ground Water, v. 7, no. 3, p. 33-35, 1969.

This article contains a summary of a few disease outbreaks caused by ground-water contamination, and the difficulties in designing and monitoring for effective quality control. There is a discussion of problems associated with large basin recharge with treated sewage. For instance, do we have adequate microbial indicators, Or will the nitrate concentration build up if there is a semiclosed circuit involved, Chlorination of well water withdrawn for domestic use is advocated as good insurance for microbial control.—Author's abstract

Roberts, R. J. *See* Zietz, Isidore. 03483

Robison, Richard A. *See* Clark, David L. 03125

03105 **Rodriguez, Joaquin; Gutschick, Raymond C.** Silicified brachiopods from the lower Lodgepole Limestone (Kinderhookian), southwestern Montana: Jour. Paleontology, v. 43, no. 4, p. 952-960, illus., tables, 1969.

Seven additional brachiopod species are described from the lower Lodgepole Limestone (Madison Group) of southwestern Montana, supplementing three forms previously described from this zone. Five are reported for the first time from the Lodgepole. Seven of the total of ten species reported thus far have been recorded from the Chouteau Group or are closely similar to Chouteau forms. Seven have been reported from the Chappel Limestone or are closely related to species therefrom. The brachiopod fauna is associated with conodonts, agglutinate foraminifera, holothurian sclerites, and other fossils which collectively corrobrate a late Kinderhookian age.—*from* Authors' abstract

03288 **Roessingh, H. K.** Geochemical exploration—A new look at an old tool: Canadian Petroleum, v. 10, no. 4, p. 20-22, illus., 1969.

Most early oil discoveries were made near oil seeps, in many of which there is vertical migration along cracks. Even without these, enough oil could migrate through the rock to show on sensitive tools. The reason why old methods failed to find this is that

there are three types of hydrocarbons present in surface beds. Three steps used to arrive at a final map are, (1) on the site sampling, (2) laboratory lithologic description and physico-chemical analysis, and (3) interpretation.—ESL

Rokach, Allan. *See* Newman, Walter S. 03582

Rolfe, W. D. I. *See* Brooks, H. K. 03492

03496 **Rolfe, W. D. Ian.** Arthropleurida, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R607-R620, illus., 1969.

Arthropleurids are rare gigantic centipede-like arthropods found only in Carboniferous swamp deposits of Europe and North America. Arthropleurida Waterlot, 1934, comprising the single known genus and species *Arthropleura armata* Jordan and Meyer, 1853 and, doubtfully, the rare genera *Bundebachiella* and *Camptophyllia*, is here provisionally regarded as a class under Myriapoda, because of lack of tagmosis of the large number of somites, uniramous limbs on all known somites, and inferred terrestrial habit. Arthropleurids differ from other myriapods by the large number of limb segments and the rosette plate at the base of each limb. Earlier authors placed them under trilobitomorphs and various crustacean classes.—VMJ

03497 **Rolfe, W. D. Ian.** Arthropoda incertae sedis, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 2: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R620-R625, illus., 1969.

Most of the following taxa have been based on inadequate material. The Devonian *Oxyuropoda* Carpenter and Swain, 1908 and *Praearcturus* Woodward, 1871, formerly considered arthropleurids, are probably isopod malacostracan crustaceans. *Mimetaster* Gurich, 1932, Devonian, once thought to be a benthonic arthropod mimicking a starfish, is here interpreted as a planktonic trilobite larva or, more likely, a branchiopod crustacean metanauplius. *Kablikia* Geinitz, 1962, Ordovician, possibly is a poorly preserved dalmanitid trilobite. *Marria* Ruedemann, 1931, Cambrian, and *Paramarria* Wells, 1944, Ordovician, originally considered crustacean nauplii, are probably dendroid graptolites. The last two genera are from North America, the others from Europe.—VMJ

Romey, William D. *See* deWaard, Dirk. 03444

03597 **Romig, P. R.; Major, M. W.; Wideman, C. J.; Tocher, Don.** Residual strains associated with a nuclear explosion: Mines Mag., v. 59, no. 6, p. 4-7, illus., 1969.

Two quartz-bar strainmeters were entrenched north of Beatty, Nevada, to observe the Benham underground nuclear test of December 19, 1968 (M = 6.3). These instruments, oriented approximately radially to the source, were located at distances of 28 km and 71 km from ground zero. Step-like residual strains of 1.8×10^{-7} and 0.35×10^{-7}, respectively were recorded. These results agree with those reported for earthquakes of M = 6.2. They also tend to substantiate the decay with distance law of $R^{-1.5}$ observed for earthquakes as opposed to the theoretical R^{-3}. It was observed that while earthquake steps do not decay within several days if at all, the strain step from Benham apparently decayed to near zero within half an hour. This decay with time appears to be a reflection of the pressure history of the cavity.—*from* Authors' abstract

03109 **Rona, Peter A.** Middle Atlantic continental slope of United States—Deposition and erosion: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1453-1465, illus., 1969.

Off Cape Hatteras, N. C., seaward-thickening strata on the continental shelf dip seaward about 1° and are exposed at, and truncated by the continental slope (about 9°); at the base of the slope, a block of landward-dipping strata about 1,500 m thick suggests massive rotational slumping. To the north, the continental slope is progressively covered by a thickening mantle of sediment. About 100 km north, strata dip

seaward about 2° and are truncated by a continental slope of 4°; and off Norfolk, Va., about 100 km further north, strata are inclined about 3°, nearly parallel with the continental slope. Submarine discharge of fresh water on the continental slope suggests seaward extensions of coastal plain aquifers, which may undermine parts of the slope and activate gravitational gliding of the sedimentary mantle.—BHK

03319 **Roscoe, S. M.** Huronian rocks and uraniferous conglomerates in the Canadian Shield: Canada Geol. Survey Paper 68-40, 205 p., illus., tables, 1969.

Uranium ore deposits of the Elliot Lake-Blind River area, and other uraniferous conglomerates near Lake Huron's north shore, are within valleys in basal Huronian greenstones of the Elliot Lake Group, at depths greater than 3,000 feet. Volcanics formerly considered pre-Horonian to the east may correlate with basalt of the Elliott Lake Group to the west. Overlying Huronian formations are described. The dominantly continental rocks are probably older than most other Aphebian rocks in the Canadian Shield which are dominantly marine. Probable Huronian correlatives in Quebec and possibly limited similar areas near Padlei, N.W.T. contain radioactive conglomerates. Deposition of the uraniferous conglomerates was controlled by disposition of Huronian lava fields, tectonic movements, and local and sourceward topography. Mineral assemblages indicate reducing conditions in the early Aphebian atmosphere.—GDC

03317 **Rose, E. R.** A progress report on experiments with chemical field tests for the detection of the rare-earth elements cerium and yttrium: Canada Geol. Survey Paper 69-15, 13 p., tables, 1969.

This report describes a number of proposed chemical field tests developed by the writer for the detection of cerium and yttrium. The tests were developed to assist the writer in his study of the geology of rare-earth deposits in Canada and they may be of help to geologists and prospectors who are also concerned with the rare-earth elements. The tests are not yet specific, and further work is required.—Author's abstract

02999 **Ross, Charles A.** Paleoecology of *Triticites* and *Dunbarinella* in Upper Pennsylvanian strata of Texas: Jour. Paleontology, v. 43, no. 2, p. 298-311, illus., 1969.

Fusulinids lived in great abundance along the margins of the Late Pennsylvanian seas of north-central, central, and western Texas on shallow carbonate or clastic depositional shelves and were scarce or absent below the edge of these shelves in the deeper water "starved" basins. Some morphological changes in the several evolving lineages were adaptive and functional and include such features as thickening of the wall, greater folding of septa, and addition of heavy internal coatings of secondary deposits that increased strength and stability of the shell. Shell shape may also have had a functional purpose. These Late Pennsylvanian fusulinids lived on the surface of the substrate and were primarily sensitive to physical and chemical ecological features of bottom currents, waves, and associated organisms.—*from* Author's abstract

02957 **Ross, June Phillips.** Champlainian (Ordovician) Ectoprocta (Bryozoa), New York State, Pt. 2: Jour. Paleontology, v. 43, no. 2, p. 257-284, illus., tables, 1969.

Rapid divergence and extensive diversification in Middle Ordovician bryozoans in New York, including *Amplexopora minnesotensis, A. conferta, A. winchelli, Dekayia sugarensis* n.sp., *Calopora dumalis, C. onealli, Anolotichia impolita, Coeloclema alternatum*, and species of *Constellaria, Helopora,, Favositella*, indicate significant evolution. Early lineages in *Amplexopora, Calopora*, and *Constellaria* are delineated. *A. minnesotensis*, like *Prasopora simulatrix*, shows important phylogenetic changes and a short duration of about 5 million years. Revision of *Coeloclema* and its type species indicate that *Diamespora* may be a descendant of *Coeloclema. Calopora* and its type species, *C. elegantula*, are also revised.—*from* Author's abstract

Roy, Rustum. *See* Muller, Olaf. 03432

03627 **Roye, W. Wayne.** Lockridge (Ellenburger), *in* Oil and gas fields in West Texas —Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 100-103, illus., 1969.

03113 **Rucker, James B.; Carver, Robert E.** A survey of the carbonate mineralogy of cheilostome Bryozoa: Jour. Paleontology, v. 43, no. 3, p. 791-799, illus., table, 1969.

The bulk skeletal carbonate composition of several Holocene species of cheilostome Bryozoa was determined by X-ray diffraction and differential straining techniques. Carbonate exoskeletons of the species studied were composed either wholly of calcite, wholly of aragonite, or of mixtures of these two calcium carbonate minerals. The amount of $MgCO_3$ in solid solution with the calcite generally ranged from four to eight percent, with a maximum of 13 percent. Most of the species belonging to the suborder Anasca were calcitic. Species belonging to Ascophora ranged from wholly calcitic to wholly aragonitic; in the species having mixed mineralogy, the site of aragonitic deposition is typically the outer surface of the frontal wall.—*from* Authors' abstract

03066 **Ruffman, Alan.** Seismic investigations of the crust in the Hudson Bay region, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 307-314, illus., 1969.

Travel-time plots in Hudson Bay yielded an average basement velocity of 6.33 kmps; the least squares velocity for the upper mantle was calculated to be 8.27 kmps. The notable features of the M-discontinuity in Hudson Bay are the somewhat irregular topography, the irregular rise of the crust-mantle interface to shallow depths under Chesterfield Inlet, the persistent rise of the interface from Churchill to a shotpoint approximately 670 km away and its sudden drop to greater depths east of that shot. It is concluded that location of the Churchill-Superior boundary at depth may be different from that at the surface. The boundary is considered as a three-dimensional plane dipping at fairly lowangles northwest under Ottawa Islands. The dip of the boundary eventually becomes approximately vertical, and it is along this vertical dip line that major gravity anomalies and possible deep-seated magnetic effects may be expected.—KAF

02980 **Runnells, Donald D.** The mineralogy and sulfur isotopes of the Ruby Creek copper prospect, Bornite, Alaska: Econ. Geology, v. 64, no. 1, p. 75-90, illus., tables, 1969.

Chalcopyrite, bornite, chalcocite, and tennantite are the important primary copper minerals, pyrite the dominant sulfide in this stratiform deposit in Devonian carbonate rocks. Horizontal and vertical mineral zoning are prominent; copper-iron ratio decreases outward from a core. Isotopic evidence suggests that sulfur of deposit is magmatic hydrothermal, and that pyrite in associated phyllites is sedimentary. Wallrock alteration is apparently absent, though pre-ore cymrite (hydrous Ba-Al silicate) has mode of occurrence like copper minerals. Dolomitization is prominent but not genetically related to the sulfides. Supergene alteration extends to depths of 200-300 feet; djurleite is the most prominent supergene sulfide.—WSW

Russell, Dale A. *See* Colbert, Edwin H. 03137

03143 **Rust, W. David.** Radon concentration in a mountain canyon environment [abs.]: Colorado-Wyoming Acad. Sci. Jour., v. 6, no. 2, p. 30, 1969.

03046 **Saad, Afif Hani.** Magnetic properties of ultramafic rocks from Red Mountain, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4234B-4235B, 1969.

03450 **Sabatier, Germain.** Palygorskite from the deep sea—A discussion [of paper by E. Bonatti and O. Joensuu, 1968]: Am. Mineralogist, v. 54, nos. 3-4, p. 567, 1969.

The author knows of at least one other occurrence of palygorskite from the deep sea (Heezen et al, 1965). Concerning the origin of this mineral, it could have been inherited from neighboring lands where deposits have been described, or it could have originated as the writers suggest (ibid., v. 53, p. 975-983), by hydrothermal reaction.—ESL

03462 **Sabine, P. A.** Memorial of Charles Findlay Davidson—July 16, 1911-November 1, 1967: Am. Mineralogist, v. 54, nos. 3-4, p. 600-608, portrait, 1969.

Sable, Edward G. *See* Withington, Charles F. 03636

03628 **Sackett, D. H. Oates, NE (Devonian, Ellenburger),** *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 104-108, illus., 1969.

Sacks, I. Selwyn. *See* James, David E. 03393

03293 **Saidova, Kh. M.** Quantitative distribution of benthic foraminifera in the northeastern Pacific, *in* Oceanographic research by the 'Vityaz' in the North Pacific . . . (translated from Russian, Akad. Nauk SSSR Inst. Okeanologii Trudy, v. 45, 1961): Springfield, Va., U.S. Clearinghouse Federal Sci. and Tech. Inf., p. 63-68, illus., table, 1969.

The arenaceous foraminifera in the northeastern Pacific fall into two groups, those inhabiting the lower continental slope and those inhabiting the ocean floor. From the quantitative distribution and occurrence of the different species of benthic foraminifera in the northeastern Pacific, it is possible to delineate the principal faunistic zones and subzones and compare them with analogous data for the northwestern Pacific. The arenaceous foraminifera of the northwestern Pacific also show two maximums in depth distribution, but at different depths; likewise, the calcareous foraminifera of the northeastern Pacific have two maximums, at shallower depths than the arenaceous foraminifera, but those in the northwestern Pacific have only one.—DBV

02992 **Sandberg, Philip A.; Plusquellec, Paul L.** Structure and polymorphism of normal pores in cytheracean Ostracoda (Crustacea): Jour. Paleontology, v. 43, no. 2, p. 517-521, illus., 1969.

The scanning electron microscope was used to study the detailed morphology of normal pores among living and fossil (Miocene-Quaternary) Cytheracea. Simple and sieve-type normal pores were found on valves of the same individual. There is considerable diversity of normal pore structure, and apparent relationship between types of normal pores and certain taxonomic groups.—RCD

03480 **Sanders, John E.; Friedman, Gerald M.** Position of regional carbonate/noncarbonate boundary in nearshore sediments along a coast—Possible climatic indicator: Geol. Soc. America Bull., v. 80, no. 9, p. 1789-1795, illus., 1969.

Since Late Cretaceous time the regional carbonate/noncarbonate boundary along the Atlantic Coast has shifted, presumably in response to climate, from a southerly position during cool times to a northerly position during warm times. At least once during the Quaternary a northern position of the carbonate/noncarbonate boundary coincided with a low sea level. This is contrary to the theory that warm Quaternary climates coincided with high sea levels, and suggests a lag between maximums of warmth and maximums of submergence. A maximum of warmth seems to have preceded the present maximum of submergence by 13,000 years.—WHN

02984 **Sanderson, G. A.** A bibliography of the family Fusulinidae, addendum 6: Jour. Paleontology, v. 43, no. 2, p. 563-567, 1969.

Addendum 6 consists of 155 references dealing with fusulinida Foraminifera, bringing the cumulative total in this series to 2015. A large number of additional references from several sources were received too late, and will be included in Addendum 7.—*from* Author's introduction

03596 **Sando, William J.; Mamet, Bernard L.; Dutro, J. Thomas, Jr.** Carboniferous megafaunal and microfaunal zonation in the northern Cordillera of the United States: U.S. Geol. Survey Prof. Paper 613-E, p. E1-E29, illus., table, 1969.

Comparison of a 12-zone biostratigraphic scheme based on corals and brachiopods with a 15-zone scheme based on foraminifers results in consistent chronostratigraphic correlations of the Mississippian of the northern Cordilleran region both within the Cordilleran basin and with the type Mississippian sequence. Correlations

with standard Carboniferous sequences in western Europe are also proposed. Except for the Kinderhook (early Tournaisian) interval, the resolution of the foraminiferal zones is as fine or finer than that of the megafaunal zones. A higher degree of cosmopolitanism in the foraminiferal faunas makes them generally more useful than megafaunas for correlation with the type Mississippian and standard Carboniferous sequences in western Europe.—WJS

Sanford, B. V. *See* Norris, A. W. 02971

03124 **Satterfield, Ira R.; Thompson, Thomas L.** Phosphatic inarticulate brachiopods from the Bainbridge Formation (Silurian) of Missouri and Illinois: Jour. Paleontology, v. 43, no. 4, p. 1042-1048, illus., 1969.

Two hundred and two specimens of *Artiotreta parva* Ireland and two specimens of *Acrotretella siluriana* Ireland were recovered from the basal limestone unit of the Bainbridge Formation of the southeastern Missouri area. Recovery of these forms indicates a possible correlation with the Clarita Formation of the Arbuckle Mountain area in Oklahoma (Ireland, 1961).—Authors' abstract

Scheidegger, A. E. *See* Liao, K. H. 03721

03535 **Schilling, John H.** Metal mining districts of Nevada (2d edition): Nevada Bur. Mines Map 37, scale 1:1,000,000, 1969; originally published 1964.

03452 **Schmidt, E. D. D.; Kirk, J. L.; Vedam, K.** Variation of the refractive index of diamond with hydrostatic pressure to 7 kilobars—Addendum [to 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 569, 1969.

The work of Waxler and Wier (1965), which also carried out measurements in dn/dP on diamond up to a maximum pressure of one kilobar, has an error which causes the value of $p(dn)dp$ in table 2 to be incorrect. If the experimental data in table 1 are used with values of the elastic constants of diamond by McSkimmin and Bond (1957), the value of pdn/dp is in excellent agreement with the authors' results (ibid., v. 53, p. 1404).—ESL

03002 **Schopf, Thomas J. M.** Paleoecology of ectoprocts (bryozoans): Jour. Paleontology, v. 43, no. 2, p. 234-244, illus., table, 1969.

Two new relationships noticed in collections of ectoprocts off New England may have paleoecologic applications: the proportion of erect species, relative to encrusting species, increases regularly with depth; erect species that are rigid rather than flexible are found extensively in samples from deeper than 35 m but are rare in shallower water. In addition, species diversity (number of species per station) increases from 15 in sublittoral areas to a maximum of 33 in depths of 50 to 100 m, and decreases to 10 in depths of 250 m. Major environmental influences reflected in growth forms are: rate of sedimentation and turbulence, substratum, salinity, and possibly wave energy and currents. Variations in temperature, light, pressure, and dissolved nutrients and gasses are not known to be influential.—*from* Author's abstract

03357 **Schubel, J. R.; Gardner, Marjorie.** Oceanographic training cruises for earth science teachers: Jour. Geol. Education, v. 17, no. 3, p. 95-98, illus., 1969.

An outstanding field experience in the in-service Earth Science Curriculum Project institute for secondary school teachers, at the University of Maryland, is an all-day oceanographic cruise in which each teacher is involved in using oceanographic data and instruments aboard Johns Hopkins University's catamaran R/V WARFIELD, conducted by its Chesapeake Bay Institute staff. Three one-day cruises combined lecture, demonstration, and firsthand introduction to some techniques used to understand, interpret, and predict biological, chemical, geological, and physical processes in the marine environment. Studies included examination of a bottom sediment core, salinity, temperature-depth profile and current measurement, and suspended sediment and plankton sampling. Post-cruise discussion amplified the topics introduced.—GDC

Schumacher, Dietmar. *See* Ethington, R. L. 02990

03164 **Schwartz, Michael.** Mass transport in calcium silicates [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3728B, 1969.

03187 **Scott, Steven Donald.** Stoichiometry and phase changes in zinc sulfide [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3852B-3853B, 1969.

03397 **Searight, T. K.; Smith, W. H.** Strippable coal reserves of Illinois—Pt. 5B, Mercer, Rock Island, Warren, and parts of Henderson and Henry Counties: Illinois Geol. Survey Circ. 439, 22 p., illus., tables, 1969.

Reserves of coal, 18 inches or more thick with overburden not exceeding 150 feet, in these counties are confined to the Rock Island (No. 1) Coal in this study; areas of reserves of the Colchester (No. 2) Coal Member are included in Parts 4 and 5A of the report series. A map shows the boundary of Pennsylvanian strata, outcrops of the Rock Island (No. 1) Coal Member and the No. 2 Coal, coal thicknesses, overburden limit of 150 feet, and mined-out areas. Stratigraphic relations of the coal deposits are shown on a series of north-south and east-west cross sections. Based on average coal thickness, approximately 200 million tons of strippable coal reserves in the ground are estimated. Several other local occurrences of minable thickness are described, but no estimate of strippable reserves was made for them because of their limited extent.—*from* Authors' abstract

03065 **Seed, H. Bolton.** Seismic problems in the use of fills in San Francisco Bay, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 87-99, illus., 1969.

Investigations of the behavior of San Francisco Bay mud under seismic loading conditions indicate that: (1) under level ground conditions there is no evidence to indicate the clay portion would settle or liquefy during an earthquake; (2) sand seams in the clay may liquefy during strong ground motions causing a small settlement as the pore pressures in the seams dissipated after the earthquake; (3) slopes and adjacent land composed of or underlain by the clay may slide during an earthquake; and (4) the deformable nature of the mud will cause any deposit containing a substantial thickness of the clay to vibrate at a relatively low frequency. Sand deposits in the bay are likely to be loose to medium dense and under earthquake loading conditions are potentially vulnerable to: (1) settlement due to soil compaction; (2) liquefaction with resulting settlement of overlying materials and structures; and (3) liquefaction and resulting flow slides.—KAF

03051 **Seeland, David A.** Marine current directions in upper Precambrian and Cambrian rocks of the southwestern United States, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 123-126, illus., 1969.

Crossbed measurements were made at 65 localities in upper Precambrian and Cambrian rocks of the southwestern United States. Marine currents are illustrated by both a vector mean map and a moving average map. Shorelines inferred from biostratigraphic studies of Lochman-Balk (1956) are shown. Although the vector mean map shows westerly currents at most localities, the consistency of the readings at each locality varies. Marine currents were mostly perpendicular to inferred shorelines, except in southeastern Arizona where the paleontologically postulated shorelines bend sharply southeastward. Here the current pattern determined from crossbedding orientations does not confirm the biostratigraphic evidence for such a change in shoreline orientation.—KAF

03307 **Segal, Ronald H.** A re-examination of the Carboniferous fossil *Nucellangium glabrum*: Am. Midland Naturalist, v. 81, no. 1, p. 272-276, illus., 1969.

The Carboniferous fossil, *Nucellangium glabrum*, is described and is shown to be ovular in nature, and to be assignable to the Cardiocarpales.—KAF

03274 **Seigle, George A.; Bermúdez, Pedro J.** Informe preliminar sobre los foraminíferos del terciario del sur de Puerto Rico, Pt. 1 [with English abs.]: Caribbean Jour. Sci., v. 9, nos. 1-2, p. 67-80, illus., 1969.

Foraminifera of the type locality of the Miocene Ponce Formation and related formations of southern Puerto Rico are discussed; four planktonic zones are recognized. The Juana Diaz Formation contains two Oligocene zones: *Globigerina ampliapertura* and *Turborotalia opima opima-Globigerina ciperoensis ciperoensis*; the latter is also known from Cuba and Trinidad. The "Angola limestone" at the base of the Ponce has a distinct fauna and is in the *Globigerinita dissimilis-Globigeneroides trilobus primordius* Zone. Overlying the "Angola limestone" is the Miocene *Globigerinatella insueta* Zone. Higher in the section planktonic Foraminifera are rare and nonsignificant. Paleoecological interpretations from the various zones are proffered. There are 251 species of Foraminifera in the four zones.—*from* Authors' abstract

Shabica, Charles W. *See* Richards, R. Peter. 03115

Shepard, Frank. *See* Fox, Paul J. 03587

03290 **Shepherd, J. B.** Comment on a paper by J. D. Eisler, "Investigation of a method for determining stress accumulation at depth" [1967]: Seismol. Soc. America Bull., v. 59, no. 2, p. 1009-1011, 1969.

Eisler's interpretation of his experimental results (ibid., v. 57, no. 5, p. 891-911, 1967) is based on the Coulomb criterion for failure. A more realistic result might be obtained using Navier's modification of the Coulomb criterion, which suggests that resistance to shear fracture of rocks consists of two parts, one constant and the other proportional to the pressure across the plane of fracture.—DBV

03404 **Sheridan, R. E.** Subsidence of continental margins: Tectonophysics, v. 7, no. 3, p. 219-229, illus., 1969.

Interpretation of seismic and well data indicates that the Blake-Bahama basin has subsided at least 5 km since earliest Cretaceous and has an upper crust mostly of marine sedimentary rocks of pre-Cretaceous age to depths of about 8 km. The seismic structure shows sedimentary layers of 1.82, 2.84, and 2.64 kmps, over a 6.65 kmps crystalline basement and a 7.49 kmps layer at 11.75 km. Restoration of the basin suggests: pre-Jurassic orogeny along the old North American continental margin; emplacement of ultrabasic intrusions forming the 7.4-kmps layer at shallow depth; uplift and erosion of basement; subsidence of unstable denser crust, beginning by Jurassic, with accumulation of sediments but with little deposition since earliest Cretaceous. Comparisons are made with Caribbean, Gulf of Mexico, and Mediterranean basins.—VSN

Shirokova, E. I. *See* Balakina, L. M. 03083

03047 **Shive, Peter Northrup.** The effect of internal stress on remanent magnetic properties of nickel [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4235B, 1969.

03604 **Shklanka, R.** Bruce Lake area, District of Kenora (Patricia Portion): Ontario Dept. Mines Prelim. Geol. Map P. 379, scale 1 in. to 1/4 mi., text, revised 1969; originally published 1966.

Volcanic rocks of the Bruce Lake area are mainly tuffaceous, fine-grained, thin-bedded and dacitic. Metasediments are predominantly well-bedded, fine-grained greywacke with associated magnetite-quartz iron formation. Three ages of granitic rocks can be recognized. Pleistocene lake clays with local sand lenses mantle most of the area which has been subjected to repeated deformation, intrusion, and metamorphism. Two ore zones have been outlined in the iron formation which constitutes a crude ore of approximately 30 percent Fe. Other resources are minor amounts of disseminated pyrite, tourmaline veinlets, and sand and gravel.—MCM

03136 **Short, Lester L., Jr.** A new genus and species of gooselike swan from the Pliocene of Nebraska: Am. Mus. Novitates, no. 2369, 7 p., illus., 1969.

A partial coracoid has been recovered from late Pliocene deposits in Frontier County, Nebr. Comparison of the fossil with extant and fossil species demonstrates that it represents a new anserine species close to the swans, but with certain gooselike features. The fossil is assigned to a new genus and species, *Paracygnus plattensis*.—KAF

03646 **Sides, Jerry F.** Block 11 (Devonian), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 23-25, illus., 1969.

03448 **Simpson, Dale R.** Oxygen-rich apatite: Am. Mineralogist, v. 54, nos. 3-4, p. 560-562, table, 1969.

Apatite containing over 2 percent excess oxygen has been synthesized at 100°C. This apatite is hexagonal; although it has an abnormally large α relative to hydroxylapatite. Heating experiments indicate that the excess oxygen is retained to more than 580°C.—Author's abstract

03625 **Sisler, John J.** JM (Ellenburger), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 89-92, illus., 1969.

03550 **Skog, Judith E.; Andrews, H. N.; Mamay, S. H.** *Canipa quadrifida*, gen. et sp. nov., a synangial fructification from the Middle Pennsylvanian of West Virginia: Torrey Bot. Club Bull., v. 96, no. 3, p. 276-287, illus., 1969.

A fossil plant compression specimen is described that consists of a nonlaminate, pinnate branch system bearing terminal synangia. The synangia are about 2 mm long and consist of four sporangia each of which includes about 400 spores. The fossil seems to be most closely related to certain species of Zeilleria and is tentatively regarded as the microsporangiate organ of a pteridosperm.—Authors' abstract

03650 **Slankis, J. A.; Becker, A.** Telluric and magneto-telluric measurement at 8 Hz: Soc. Mining Engineers Trans., v. 244, no. 2, p. 237-244, illus., 1969.

Equipment has been developed to utilize natural 8 Hz electromagnetic fields to measure rock resistivities. Telluric and magnetotelluric surveys have detected resistivity variations associated with geological contacts and metallic sulfide deposits. The fundamental premises of these methods are illustrated by the results of surveys across a Precambrian-Paleozoic contact in the Ottawa Valley and a near-surface sulfide deposit in northern Quebec. Such interfaces are characterized not only by variations in apparent resistivity, but also, unexpectedly by the spatial anisotropy of the electric fields and the presence of a strong vertical magnetic field component in their vicinity.—Authors' abstract

03479 **Smart, J. S.** Topological properties of channel networks: Geol. Soc. America Bull., v. 80, no. 9, p. 1757-1773, illus., tables, 1969.

A method of classifying channel networks is proposed, intermediate in detail between exact description and the broad specification by Strahler stream numbers. The new classification, termed "ambilateral," has the basic rule that two topologically distinct channel networks belong to the same class if one can be converted into the other by reversal of the right-left order at one or more junctions. Statistical analysis of 86 U.S. stream-system networks generally support Shreve's hypothesis of topological randomness except that stream-number data for western U.S. show too many large (>4) bifurcation ratios. Deviations from the topologically random model may be used to infer geological controls.—*from* Author's abstract

Smerdon, Ernest T. *See* Rahman, Md. Ataur. 03330

Smith, Albert. *See* MacPhail, Donald. 03367

03379 **Smith, Albert; McPhail, Donald; Vermeer, Donald.** Potential applications and benefits of satellite photography, *in* Earth resource surveys from spacecraft, V. 2, (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. H3-H5 [1969?].

Satellite photography has considerable value both as a research and pedagogical tool, especially in arid environments. Remote sensing of the environment has a practical benefit to regional studies. Three areas described are central Chile, the Kainji Dam Project, Nigeria, and the arid United States. Teaching applications are discussed also.—ESL

Smith, Albert W. *See* MacPhail, Donald D. 03372

Smith, J. V. *See* Bennett, J. M. 03326

03459 **Smith, J. V.** The crystal structure of staurolite—Errata [to 1968 paper]: Am. Mineralogist, v. 54, nos. 3-4, p. 571, 1969.

The statement in the original paper (ibid., v. 53, p. 1139-1155) that the O(1A)—O(1B) edge of the Al(2) octahedron is not shared with another polyhedron is incorrect, and should be omitted. The first paragraph of p. 1154 should end after the second complete sentence.—ESL

Smith, W. H. *See* Searight, T. K. 03397

03477 **Snetsinger, Kenneth G.** Manganoan ilmenite from a Sierran adamellite: Am. Mineralogist, v. 54, nos. 3-4, p. 431-436, table, 1969.

Manganoan ilmenite occurs as a late minor accessory constituent of an adamellite in the northwest part of the Bass Lake quadrangle, Mariposa County, California. The mineral is not zoned, but does show appreciable grain-to-grain variation in manganese and iron. Electron microprobe analysis of a grain containing highest manganese gives MnO 11.1, FeO 28.8, TiO_2 52.0, Fe_2O_3 4.5, Mn_2O_3 3.3, Al_2O_3 0.3, V_2O_3 0.06 weight percent, summation 100.06 percent, corresponding to the structural formula $[Fe^{2+}_{1.19}Mn^{2+}_{0.47}][Ti_{1.94}Fe^{3+}_{0.17}Mn^{3+}O_{.12}Al_{0.02}V_{0.002}]O_6$. Valence states of manganese and iron were estimated with the electron microprobe by comparing the $L\alpha_{1,2}L\beta_1$ intensity ratios of these elements with an analyzed ilmenite and a synthetic oxide.—Author's abstract

03108 **Sohn, I. G.** Validity of *Cavellina* Coryell, 1928 (Ostracoda): Jour. Paleontology, v. 43, no. 3, p. 842, 1969.

Cavellina Maitland, 1897 (Tunicata) is an incorrect subsequent spelling of *Clavelina* Savigny, 1816 and has no status in nomenclature and, therefore, does not enter into homonymy with *Cavellina* Coryell, 1928 (Pennsylvanian ostracodes, Oklahoma), as stated by Schallreuter (1968).—RCD

03180 **Soregaroli, Arthur Earl.** Geology of the Boss Mountain mine, British Columbia [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3793B-3794B, 1969.

03287 **Soukoreff, W. W.** Using the gravimeter to define Leduc pinnacle reefs: Canadian Petroleum, v. 10, no. 4, p. 32-34, illus., 1969.

Seismic surveys have been credited with discovery of most of the pinnacle reefs in central Alberta, but many anomalies were drilled that did not find any reef development. Modern seismic methods, however, define the pinnacle reefs clearly, but their small size requires very detailed seismic coverage. Main reasons for reluctance to try gravity were: (1) small density contrast between hydrocarbon filled reef and dense calcareous shales, (2) the very detailed survey that was necessary, and (3) interpretation. These problems have been changed more recently and an experimental gravity survey program was initiated covering most of the Leduc reefs. Out of the 17 reef studies that can be released, 15 produce recognizable residual gravity anomalies. The Bonnie Glen discovery is described as an example.—ESI

Spence, William H. *See* Vogel, Thomas A. 03471

03040 **Spence, William Henry.** Relict plagioclase phenocrysts from metavolcanic rocks mantling a granite dome and the petrology of the associated rocks in the Grenville Province of southeastern Ontario [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4232B, 1969.

03181 **Spencer, Randall Scott.** A multivariate analysis of variance study of *Neochonetes granulifer* (Owen)—Its implications with respect to evolution, correlation, and time stratigraphy [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3794B, 1969.

03023 **Sridharan, Asuri.** Some studies on the strength of partly saturated clays [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4163B, 1969.

03024 **Stafford, Donald Bennett.** Development and evaluation of a procedure for using aerial photographs to conduct a survey of coastal erosion [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4163B-4164B, 1969.

03318 **Steacy, H. R.; Jambor, J. L.** Nature, distribution and content of zirconium and niobium in a silico-carbonatite sill at St-Michel, Montreal Island, Quebec: Canada Geol. Survey Paper 69-20, 7 p., illus., tables, 1969.

A silico-carbonatite sill exposed in the Francon (1966) Ltée quarry at St-Michel, Montreal Island, Quebec, contains approximately 0.09 percent ZrO_2 and 0.11 percent Nb_2O_5. The sill consists predominantly of feldspar and dawsonite. Zirconium is present as zircon and weloganite, the latter occurring megascopically in vesicles and cavities which are a prominent feature of the sill. Niobium is present as pyrochlore which is finely disseminated in the rock matrix.—Authors' abstract

03110 **Stearn, Colin W.** The stromatoporoid genera *Tienodictyon*, *Intexodictyon*, *Hammatostroma* and *Plexodictyon*: Jour. Paleontology, v. 43, no. 3, p. 753-766, illus., 1969.

The species of stromatoporoids characterized by complexly intertwining pillar tissue between plane laminae, of the genera *Intexodictyon* (Lower to Upper Silurian), *Plexodictyon* (Ludlovian), *Hammatostroma* (Lower Devonian to Frasnian) and *Tienodictyon* (Middle, Devonian) are described, illustrated, and compared, and their evolution is discussed. Geographic occurrences include U.S.S.R. in Europe and Asia, China, and parts of north-central U.S. and Arctic and western Canada. The holotypes of *Tienodictyon zonatum* and *Clathrodictyon cystosum lineatum* (= *Plexodictyon lineatum*) are reillustrated and described. A new species, *Plexodictyon waparksi* from the Upper Silurian of Devon Island, N.W.T., Canada, is proposed.—JWH

Steele, H. Miriam. *See* Norford, B. S. 03589

03014 **Steinbrugge, Karl V.** Seismic risk to buildings and structures on filled lands in San Francisco Bay, *in* Geologic and engineering aspects of San Francisco Bay fill: California Div. Mines and Geology Spec. Rept. 97, p. 101-115, illus., table, 1969.

The history and certain aspects of the present state of the art of structural design on bay fills is reviewed. Some of the factors that determine the various types of seismic risk from the structural engineering standpoint are delineated. Seismic risk depends on many variables such as the type of construction, as well as the type of soil beneath a structure. Seismic risk also depends on viewpoint; serious building damage does not necessarily require an equal hazard to life. It is recommended that all potential developable San Francisco Bay fill areas be zoned into four categories: minimum, moderately, substantially, and maximum increased risk zones. A map showing these zones should be available to the public.—KAF

Stephenson, D. A. *See* Born, S. M. 03429

Stevens, Anne E. *See* Kasahara, Keichi. 03080

03182 **Stitt, James Harry.** Late Cambrian and earliest Ordovician trilobites, Timbered Hills and lower Arbuckle Groups, western Arbuckle Mountains, Murray County, Oklahoma [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3794B-3795B, 1969.

03004 **Stokes, William Lee; Thompson, Albert Ervin.** The San Rafael Group in the Lake Powell region, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 184-189, illus., 1969.

The San Rafael Group (Middle and Late Jurassic) of the southwestern Colorado Plateau is characterized by an abundance of clastic sediments, red siltstone and mudstone, evidence of wind action, absence of grits and conglomerates, rapid facies changes, few key beds, and a paucity of fossils. Rocks of the Carmel Formation, the Entrada Sandstone, and the Curtis-Cummerville interval in the Kaiparowitz plateau and Lake Powell region are correlated with the better known type sections of central Utah and with marginal units that have been named and mapped in northeastern Arizona. Four significant unconformities within the San Rafael Group are discussed. The most distinct one separates the Curtis and Entrada formations while another unconformity underlies the sandstone unit below the upper member of Entrada Sandstone. Other contacts are at the base of the Morrison sand of the Cretaceous.—KAF

03145 **Stott, D. F.** Fernie and Minnes strata north of Peace River, foothills of northeastern British Columbia: Canada Geol. Survey Paper 67-19, pt. B, 132 p., illus., geol. map, 1969.

This report presents stratigraphic information from 23 sections measured in [Jurassic to Early Cretaceous] Fernie and Minnes strata that outcrop in northeastern British Columbia. The general geology of the area has been described in Canada Geol. Survey Paper 67-19, pt. A, Stott, 1967. [See Abstracts of North American Geology for March 1968.]—*from* Author's abstract

03524 **Strahler, Arthur N.** Physical geography (3d edition): New York and London, John Wiley and Sons, 733 p., illus., tables, 1969; originally published 1951.

This introductory study should enable the student who will not take advanced courses in physical geography or related sciences to appreciate and understand elementary principles of phenomena to which he is exposed. In part 1, *the earth as a globe*, new material on axiumths and the Earth's magnetic field has been added. The major change in part 2, *atmosphere and oceans*, is an introductory chapter describing the atmosphere with its concentric shells and extensions into space. Additions to part 3, *climate, soils, and vegetation*, includes material on several topics. Innovations to part 4, *landforms*, are the addition of Murphy's newly published worldwide system of landform classification, and a new chapter on quantitative geomorphology. The bibliography has been updated and expanded.—MCM

Stroud, Lowell. *See* Tully, P. C. 03403

03539 **Sumner, John S.** Geophysics, geologic structures and tectonics: Wm. C. Brown Company Publishers (Brown Found. Earth Sci. Ser.), 115 p., illus., tables, 1969.

This book is intended to present new, introductory material in geophysics and structural geology so that the scope of these fields will become apparent to the student early in his study of geology. Its purpose is to stimulate and give reasons for a student to do better in applied mathematics and physics, or to attract people in these fields to the study of earth science. Chapter headings are: introduction, physical characteristics of earth materials, geophysics and study of the Earth, gravity, magnetism, earthquakes and seismology, heat from the Earth, Earth's interior, faults and folds, orogeny, and tectonic hypotheses. Each chapter includes a summary and suggested reading; a bibliography and index are appended.—MCM

03620 **Superior Oil Company.** Grey Ranch, *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 65-69, illus., 1969.

03087 **Suttner, Lee J.** Stratigraphic and petrographic analysis of Upper Jurassic-Lower Cretaceous Morrison and Kootenai Formations, southwest Montana: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1391-1410, illus., 1969.

Sand-shale ratio maps and petrographic and X-ray data from the Morrison and Kootenai Formations of southwestern Montana suggest significant changes in the tectonic and sedimentologic framework of the northern Rocky Mountains during Late Jurassic-Early Cretaceous time. The character of the Morrison sandstone indicates a cratonic source or more possibly a southern source in the Precambrian crystalline rocks exposed in Colorado in Late Jurassic. The lower Kootenai sandstone was primarily derived from Permo-Pennsylvanian rocks of Idaho and indicates Early Cretaceous uplift in that area. Development of the Kootenai clastic-wedge geometry and pyroclastic deposition in the overlying Colorado Group reflect migration of the mobile zone eastward toward Montana which climaxed in Late Cretaceous and early Tertiary with the Laramide orogenic pulse in central-western Montana.—*from* Author's abstract

02962 **Swain, F. M.; Kraemer, S. A.** Amino acid components of some Paleozoic plant fossils and rock samples: Jour. Paleontology, v. 43, no. 2, p. 546-550, illus., table, 1969.

Amino acid components of a Pennsylvanian *Calamites*, a Permian *Sigillaria* and of several Paleozoic (Ordovician-Devonian) rock samples were extracted. The *Calamites* contained glycine and serine, while glutamic acid dominated the *Sigillaria* extracts. The Paleozoic rocks yielded surprisingly large amounts of amino acids, notably proline; but a Precambrian argillite analyzed in the same way yielded practically no amino acid.—SHM

03041 **Swe, Win.** Stratigraphy and structure of late Mesozoic rocks south and southeast of Clear Lake, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4233B, 1969.

Sykes, Lynn R. *See* Molnar, Peter. 03481

03134 **Szalay, Frederick S.** Uintasoricinae, a new subfamily of early Tertiary mammals (?Primates): Am. Mus. Novitates, no. 2363, 36 p., illus., tables, 1969.

Discovery of a fragmentary specimen of *Uintasorex* from upper Bridger beds at Tabernacle Butte in Wyoming has prompted a re-evaluation of *Uintasorex* and *Niptomomys*. *Uintasorex* and *Niptomomys* are placed in a new subfamily of their own, Uintasoricinae, and on the basis of dental evidence are referred to the superfamily Microsyopidae. Because the ear region of *Microsyops* is decidedly more primitive than that of any known primate, unquestioned allocation of the family to the Primates is not advisable.—KAF

03152 **Szalay, Frederick S.** The Hapalodectinae and a phylogeny of the Mesonychidae (Mammalia, Condylarthra): Am. Mus. Novitates, no. 2361, 26 p., illus., table, 1969.

Previously unreported hapalodectine mesonychids from the early Eocene of North America and the late Eocene of Central Asia are described and the systematics of this subfamily is reviewed. It is suggested that the subfamily was probably distinct from mesonychines prior to the middle Paleocene. There appear to be three possibilities for the origin of the Hapalodectinae: (1) differentiation from early or middle Paleocene mesonychids, more primitive than known mesonychines; (2) derivation from Asiatic or North American mesonychines during the Paleocene, or (3) *Hapalodectes* and their allies represent a distinct family derived from unknown sources. As a result of a re-evaluation of the interrelationships of mesonychid genera, a tentative phylogeny, together with continental occurrences, is presented.—KAF

03282 **Szalay, Frederick S.** Mixodectidae, Microsyopidae, and the insectivore-primate transition: Am. Mus. Nat. History Bull., v. 140, art. 4, p. 195-330, illus., tables, 1969.

The Paleocene Mixodectidae and the Eocene Microsyopidae are clearly separated. An undoubted derivation of mixodectids from any of the known Cretaceous or Paleocene families is not possible. The possibility of a close plagiomenid-mixodectid

affinity is re-examined, and some new evidence is described and illustrated. From evidence of dental morphology, the microsyopids may be derivable from the earliest primates. The insectivore-primate transition was probably initiated at the end of the Cretaceous or earlier by behavioral and physiological adaptations. The apatemyids and tupaiids are considered to be independently derived families from the Insectivora, not the Primates.—KAF

Tappan, Helen. *See* Loeblich, Alfred R., Jr. 02985

03183 **Tarr, Arthur Charles.** The dispersion of Rayleigh waves in the crust and upper mantle under the western North Atlantic Ocean, Gulf of Mexico and Caribbean Sea [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3795B, 1969.

03387 **Tasch, Paul.** Branchiopoda, *in* Treatise on invertebrate paleontology—Pt. R, Arthropoda 4, V. 1: Boulder, Colo., Geol. Soc. America (and Univ. Kansas Press), p. R128-R191, illus., 1969.

The class Branchiopoda Latreille, 1817 is characterized by flattened, leaflike, lobate swimming appendages. Ninety-nine genera, plus 20 doubtfully assigned to Conchostraca, are here described; numerous extant genera are excluded. Subclass Diplostraca, with bivalved or folded carapace, contains the important orders Conchostraca (Devonian-Holocene) and Cladocera (Oligocene-Holocene). Two new subclasses are proposed: Calmanostraca, with shieldlike carapace, to contain Notostraca (Upper Carboniferous-Holocene), Kazacharthra (Jurassic), and Acercostraca (Lower Devonian); Sarsostraca, no carapace,to contain Anostraca (Devonian-Holocene) and Lipostraca (Devonian). Morphology, ecology, and geologic occurrence are discussed.—VMJ

Taylor, F. C. *See* Mulligan, R. 03279

02982 **Teichert, Curt.** Names and authorship of some cephalopod orders: Jour. Paleontology, v. 43, no. 2, p. 561-562, 1969.

Because the provisions of the Code of Zoological Nomenclature do not apply to naming of taxa above family-group level, uniformity in the naming of orders of ammonoid and nautiloid cephalopods is perhaps not attainable, although it remains a desirable goal. Examples of different name forms proposed, and of confusion in authorship of these, are cited.—RCD

03084 **Teisseyre, Roman.** Dislocation field dynamics as an approach to the physics of earthquake processes [with French abs.], *in* A symposium on processes in the focal region—Internat. Union Geodesy and Geophysics, 14th Gen. Assembly, Zurich, 1967: Dominion Observatory Ottawa Pubs., v. 37, no. 7, p. 199-210, 1969.

It is assumed that physical conditions prior to earthquake occurrences are described by some energy accumulation units which are connected with interior inhomogeneities of the Earth and which could be described by dislocations, cracks, or other stress singularities. The main process of internal release is described by annihilation of two dislocation lines of opposite sign; energy release can thus occur when two dislocation elements join, when a dislocation reaches the surface or any internal discontinuity, and in process of thermal stress removal by a dislocation field. Cracks or other stress singularities can be approximated by a dislocation distribution. A general approach to a unified theory by means of a dislocation density field is given; dislocation flow is assumed and related to large-scale tectonic processes.—*from* Author's abstract

Thomas, Eugene. *See* Zimmerman, J. B. 03438

Thomasson, M. Ray. *See* Thomson, Alan F. 03567

Thompson, Albert Ervin. *See* Stokes, William Lee. 03004

03603 **Thompson, Craig D.** Block 42 (Strawn, Bend), *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 26-31, illus., 1969.

03473 **Thompson, James B., Jr.** Chemical reactions in crystals: Am. Mineralogist, v. 54, nos. 3-4, p. 341-375, illus., tables, 1969.

The conditions that must be met for equilibrium in a crystal where several homogeneous reactions of various kinds may take place simultaneously are derived, and a method by which departures from ideality may be taken into account with respect to the substitutions taking place in real rather than hypothetical crystals is demonstrated. Subjects covered include: formulation of the thermodynamic properties of a crystal, homogeneous equilbria in feldspars and in hypersthene, and correlation of physical properties with ordering parameters. An appendix discusses site occupancy constraints in some mineral crystals.—ESL

Thompson, Thomas L. *See* Satterfield, Ira R. 03124

03567 **Thomson, Alan F.; Thomasson, M. Ray.** Shallow to deep water facies development in the Dimple Limestone (Lower Pennsylvanian), Marathon region, Texas, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 57-78, illus., 1969.

The Dimple Limestone (Atokan) of the Marathon region represents a period of carbonate deposition which interrupted the deposition of a thick terrigenous flysch section in the Ouachita geosyncline. It consists of laterally adjacent "shelf", slope, and basin facies from north to south. The "shelf" facies is characterized by cross-bedded fossil and oolith lime grainstones. The slope and basin facies are a sequence of limestone turbidites. The portion of the Ouachita geosyncline revealed in the Marathon region is believed to have been a basin about 40 mi wide and a few hundred feet deep in Dimple time. Turbidity currents moving down a gently-sloping bottom from the north deposited limestones on the slope as well as in the basin.—*from* Authors' abstract

03366 **Thrower, Norman J. W.** Systematic cadastral survey, *in* Earth resource surveys from spacecraft, V. 1 (Leestma, R. A., principal investigator; White, R. A., editor): Houston, Tex., Natl. Aeronautics and Space Adm., Earth Resources Group, p. D3-D4. illus. [1969?].

A photograph giving a broad view northeastward across the Sonoran Desert, including much of the arid section of California with smaller areas of Arizona, Nevada, and Mexico, is interpreted. Physiographic provinces shown are the inland extremity of the California Coast Ranges and the southern extremity of the Basin and Range region. Most prominent features are the Salton Sea and the irrigated Imperial Valley —ESL

Thurber, David H. *See* Newman, Walter S. 03582

03531 **Tien, Pei-Lin; Waugh, Truman C.; Dilts, Robert L.** Vivianite in Graneros Shale (Upper Cretaceous), central Kansas, *in* Short papers on research in 1968: Kansas Geol. Survey Bull. 194, pt. 1, p. 21-24, illus., tables, 1969.

An earthy variety of vivianite is found in marine sediments, occurring as nodular aggregates and encrustations along bedding planes and joints. Within two feet of the outcrop it is blue, and below two feet, is white. Associated minerals are jarosite and gypsum. Vivianite changes rapidly from white to blue after collection. Crystallites are lath-shaped and two to four μ in length. Endothermic reactions occur at 190°, 360°, 470°, and 570°C, and exothermic at 650° and 755°C. The infrared spectrum has wide absorption bands at 3300 and 1000^{-1}, and medium bands at 1620, 800, and 500 cm^{-1}. Field evidence suggests that iron sulfides and fossil remains in the sediments may contribute to the formation of vivianite and the associated minerals.—*from* Authors' abstract

Tocher, Don. *See* Romig, P. R. 03597

03121 **Toomey, Donald F.** The biota of the Pennsylvanian (Virgilian) Leavenworth Limestone, Midcontinent region—Pt. 1, Stratigraphy, paleogeography, and sediment facies relationships: Jour. Paleontology, v. 43, no. 4, p. 1001-1018, illus., tables, 1969.

This middle limestone unit of the Oread Megacyclothem crops out in a linear belt extending from northern Oklahoma to southeastern Iowa. Analysis of point-count data derived from samples from 32 outcrop localities, and computer factor analysis, delineated three sediment facies: skeletal-mud facies, with abundance of diverse skeletal grains; aggregate-grain facies with an abundance of relatively large algal-coated grains; mudstone facies, with high percentage of lime mud and pronounced reduction in skeletal constituents. Skeletal-mud occurs at 27 localities, and is the dominant Leavenworth Limestone facies, probably representing strongly intercorrelated elements of a closely-knit marine depositional environment. The other facies are present only at the northern and southern extremities of the outcrop belt.—*from* Author's abstract

03436 **Tremaine, Marie.** (editor). Arctic bibliography, V. 14: Montreal, Quebec, Arctic Inst. North America, 1693 p., 1969.

This volume of the bibliography prepared by the Arctic Institute of North America, abstracts and indexes scientific literature on the arctic and subarctic regions of the world primarily for the period 1964-65. It contains 8,563 abstracts in English, appearing originally in Russian, German, French, Finnish, and Scandinavian languages, and dealing with the earth, physical and life sciences, and the arts and industries —JNR

03277 **Trettin, H. P.** Lower Palaeozoic sediments of northwestern Baffin Island, District of Franklin [with French abs.]: Canada Geol. Survey Bull. 157, 70 p., illus., tables, 1969.

The succession was deposited on an erosion surface that transected earlier structures, some intermittently active; post-Silurian deformations produced the Brodeur homocline, northwest-trending faults, and fracture patterns controlling drainage. The succession comprises as much as 6,000 feet of Cambrian(?), Ordovician, and Silurian strata. The Admiralty Group, the lowest, is composed of the nonmarine Gallery sandstone and the shallow marine Turner Cliffs Formation. Overlying this Group, and extending far to the south, is the Lower and lower Middle Ordovician Ship Point Formation. It is overlain disconformably by the Brodeur Group representing a transgressive-regressive cycle with maximum submergence in Late Ordovician and Early Silurian.—*from* Author's abstract

03403 **Tully, P. C.; Stroud, Lowell.** Helium—Bibliography of technical and scientific literature, 1962, including papers on alpha particles: U.S. Bur. Mines Inf. Circ. 8398, 367 p., 1969.

References to occurrences of helium in meteorites, minerals, and natural gases are 40 in number.—APB

03525 **Turner, Daniel S.** Applied earth science: Dubuque, Iowa, Wm. C. Brown Co. Publishers (Brown Foundations of Earth Sci. Ser.), 125 p., illus., tables, 1969.

This book investigates each of the areas of earth science in which man has learned to utilize natural resources or control the forces inherent in his environment. A circular diagram, with earth science at its center, is composed of six basic disciplines—astronomy, physical geography, geology, geophysics, meteorology, and oceanography; each of the subfields on the periphery of the circle is intricately related to each of the others in many practical ways, indicating features that aroused the curiosity of ancient philosophers and that capture attention of modern scientists. Chapter headings are: earth resources, natural resources, engineers and earth science, applied climatology and meteorology, military applications of earth science, and conservation and ecology.—MCM

03568 **Tyrrell, Willis W., Jr.** Criteria useful in interpreting environments of unlike but time-equivalent carbonate units (Tansil-Capitan-Lamar), Capitan Reef Complex, West Texas and New Mexico, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 80-97, illus., 1969.

Shallow water Tansil deposits are characterized by well bedded dolomitized carbonate mudstone to grainstone and contain a predominance of nonskeletal grains. The equivalent Capitan is almost devoid of bedding. Capitan shelf edge deposits locally can be classed as skeletal wackestone, packstone, and boundstone. Capitan basin slope deposits contain coarse skeletal and intraclast debris derived from the shelf edge environment. Similar but finer grained intraclast and skeletal debris characterize the nonporous Lamar calcarenites which are interbedded with Lamar mudstones. Tansil fossils consist predominantly of algae, mollusks and foraminifers.The Capitan biota is much more diverse, consisting of more "normal marine" types. Lamar fossils are "normal marine" types but they were periodically transported into the "quiet water" basinal carbonate mud environment.—KAF

03428 **Uchupi, Elazar.** Marine geology of the continental margin off Nova Scotia, Canada: New York Acad. Sci. Trans., ser. 2, v. 31, no. 1, p. 56-65, illus., 1969.

The Scotian Shelf is bounded on the east by the Laurentian Channel and on the west by the Northeast Channel, both formed by glacial erosion. It is divided into an inner irregular zone, a central basin zone, and an outer bank zone. The slope seaward of the shelf is smooth and free of canyons to the west, but to the east is deeply entrenched by canyons. The pattern of sediment distribution on the margin is probably related to Pleistocene events. Continuous seismic profiles show that Paleozoic rocks underlie sediments in the inner zone, but coastal plain formations are present further out. A high-resolution profile suggests that both are truncated by fluvial erosion. The sedimentary framework of the continental slope is also demonstrated on the profiles. The structure of the rise is more complex than either of the others. The section in the abyssal plain is underlain by a deep irregular surface.—ESL

03159 **Udo, Eno J.** Zinc adsorption and desorption in calcareous soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3579B, 1969.

03516 **U.S. Geological Survey.** Aeromagnetic map of the Trout Creek quadrangle, Sanders and Lincoln Counties, Montana, and Shoshone County, Idaho: U.S. Geol. Survey Geophys. Inv. Map GP-685, scale 1:62,500, 1969.

03551 **U.S. Geological Survey.** Aeromagnetic map of the Plains, Perma, Superior, and Tarkio quadrangles, Sanders, Mineral, and Missoula Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-691, scale 1:62,500, 1969.

03557 **U.S. Geological Survey.** Aeromagnetic map of the Thompson Falls quadrangle, Lincoln and Sanders Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-686, scale 1:62,500, 1969.

03558 **U.S. Geological Survey.** Aeromagnetic map of the Hubbart Reservoir-Hot Springs area, Sanders, Flathead, and Lake Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-687, scale 1:62,500, 1969.

03559 **U.S. Geological Survey.** Aeromagnetic map of part of the Avery quadrangle, Shoshone County, Idaho, and Mineral and Sanders Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-689, scale 1:62,500, 1969.

03560 **U.S. Geological Survey.** Aeromagnetic map of the Haugan and St. Regis quadrangles and parts of the Simmons Peak and Illinois Peak quadrangles, Shoshone County, Idaho, and Mineral and Sanders Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-690, scale 1:62,500, 1969.

03565 **U.S. Geological Survey.** Aeromagnetic map of the Thompson Lakes quadrangle, Lincoln, Sanders, and Flathead Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-683, scale 1:62,500, 1969.

03566 **U.S. Geological Survey.** Aeromagnetic map of the McGregor Lake-Tally Lake area, Flathead and Lincoln Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-684, scale 1:62,500, 1969.

02958 **Utgaard, John.** A revision of North America genera of ceramoporoid Bryozoans (Ectoprocta)—Pt. 3, The ceramoporoid genera *Ceramopora*, *Papillalunaria*, *Favositella*, and *Haplotrypa*: Jour. Paleontology, v. 43, no. 2, p. 289-297, illus., 1969.

Ceramopora Hall (Late Ordovician-Silurian) and *Favositella* Etheridge and Foord (Silurian) are redefined and, with the new Ordovician genus *Papillalunaria*, are included in the family Ceramoporidae. *Haplotrypa* Bassler (Silurian) is tentatively retained in the family. *Dnestropora* Astrova is placed into synonymy with *Favositella*. Zoaria of *Ceramopora imbricata* Hall can have a basal lamina throughout or a calluliferous base near the margin of the zoarium or nearly throughout the zoarium. Laminations in cell walls suggest that soft tissue occupied the under surface of at least part of the colony. It is not known if modified polypides occupied tubes or cells, or if they are a kind of colonial interzooecial space. Presence or absence of a calluliferous base may depend upon size and nature of the substrate.—*from* Author's abstract

03008 **Valentine, James W.** Niche diversity and niche size patterns in marine fossils: Jour. Paleontology, v. 43, no. 4, p. 905-915, illus., 1969.

The ranges of environment-related functions that can be employed by a species at any time represent the *prospective niche size*, and the ranges of factors that are actually employed, the *realized niche size*, of a species. Patterns of niche size-frequency distributions of marine poikilotherms, for example articulate barchiopods and pelecypods, have varied as the biosphere has evolved. In shallow tropical waters, modal niche size has decreased as diversification has proceeded in that relatively stable environment, which has been enriched with species through the operation of a latitudinal, climatically-driven "diversity pump." In shallow waters of high latitudes, modal niche size has fluctuated with fluctuations in environmental changeability; at present, modal niche sizes are large.—*from* Author's abstract

Valentine, Page C. *See* Hazel, Joseph E. 03127

03007 **Vandersluis, George D.; Hauf, Charles B.** Road log, *in* Geology and natural history of the Grand Canyon region—Four Corners Geol. Soc., 5th Field Conf., Powell Centennial River Exped., 1969: [Durango, Colo.] Four Corners Geol. Soc., p. 201-212, illus., 1969.

A road log is given for a trip from Yaki Point (top of the Kaibab Trail on the South Rim of the Grand Canyon) to Lee's Ferry, Arizona, via Cameron.—KAF

03308 **VanValen, Leigh.** Variation genetics of extinct animals: Am. Naturalist, v. 103, no. 931, p. 193-224, 1969.

Many aspects of variation genetics are reviewed, especially but by no means exclusively with reference to extinct animals. The major topics covered are: polymorphism; the cause of variation; the relation of variation to evolutionary rate, stage of evolution, and niche width; changes of variation with time; range of reaction; parthenogenesis and variation; evolution of correlations; and ontogeny of variations.—Author's summary

Vedam, K. *See* Schmidt, E. D. D. 03452

03458 **Vedder, Willem; Wilkins, R. W. T.** Dehydroxylation and rehydroxylation, oxidation and reduction of micas: Am. Mineralogist, v. 54, nos. 3-4, p. 482-509, illus., table, 1969.

Muscovite dehydroxylates at 600°C in the atmosphere with loss of H_2O and minor changes of structure; it has been rehydroxylated to its original structure at 600°C and less than 15 bars of H_2O. Muscovite can be deuterated under these conditions without appreciable dehydroxylation. In biotite powders, hydrogen is lost with concomitant oxidation of Fe^{2+} at temperatures as low as 400°C, and H_2O is lost from sites near octahedral vacancies below 500°C. Even in thick sheets these hydroxyls are lost below 800°C. Hydroxyl close to 3 Mg or 2 Mg + trivalent ion in the octahedral layer

remains above 1000°C. A correlation is established between infrared and thermogravimetric data for decomposition of biotite. Infrared spectra of thin sheets of natural phlogopite confirm that no dehydroxylated phase occurs before final decomposition at 1080°C in the atmosphere.—ESL

Vermeer, Donald. *See* MacPhail, Donald. 03367

Vermeer, Donald. *See* Smith, Albert. 03379

Vermeer, Donald E. *See* MacPhail, Donald D. 03372

03430 **Vice, R. B.; Guy, H. P.; Ferguson, G. E.** Sediment movement in an area of suburban highway construction, Scott Run basin, Fairfax County, Virginia, 1961-64: U.S. Geol. Survey Water-Supply Paper 1591-E, p. E1-E41, illus., tables, 1969.

This report shows the extent to which earth materials in the Scott Run basin, Fairfax County, Va., may be eroded by rainfall and carried by stream systems during a period of disturbance of surface materials common to highway construction. The study was conducted from 1961-1964. Sediment that moved with the flow to the Potomac River was measured at the gaging station by a system of representative samples. The sediment yields for 88 storms were documented, representing the overland runoff. Construction areas contributed 85 percent of the sediment which was about twice that transported from the basin. The 88 events accounted for 37 percent of the runoff, and 99 percent of the sediment movement in 3 percent of the time. If the precipitation had been normal, the estimated gross erosion in the construction area would have been about 20 percent more than actually occurred.—JNR

Virgo, David. *See* Hafner, Stefan S. 03588

03471 **Vogel, Thomas A.; Spence, William H.** Relict plagioclase phenocrysts from amphibolite grade metavolcanic rocks: Am. Mineralogist, v. 54, nos. 3-4, p. 522-528, illus., table, 1969.

Relict plagioclase phenocrysts have changed composition and have [inverted to an] ordered [structural state] by solid state diffusion without recrystallization. Original twin planes are preserved, and the orientation of the optical indicatrix with respect to the twin plane has readjusted to reflect the new composition and structural state. —Authors' abstract

03324 **Vokes, Harold E.** Note on the occurrence of *Panopea bitruncata* (Conrad): Tulane Studies Geology and Paleontology, v. 7, no. 1, p. 41-42, illus., 1969.

Conrad (1872) originally described this pelecypod from a valve found at Beaufort, N.C. In later years, the species was found as isolated valves from North Carolina to the Florida west coast; neither a living animal nor a definitely fossilized specimen was ever found. Recently Vokes collected two specimens with paired valves from a shell bed in the diapiric "Mudlump 90" west of the South Pass of the Mississippi Delta; the bed was radiocarbon dated (J. P. Morgan and others, 1968) at 15,500 yr B. P. and the fauna suggested water depths of 100-200 feet during deposition. Occurrence of this species in the mudlump fauna does not settle the problem of whether it is extinct, but does clearly indicate its deep-water, deep-burrowing habitat, which would preclude its being taken alive by usual dredging methods.—VMJ

03325 **Vokes, Harold E.** The anadarid subgenus *Caloosarca* in the western Atlantic region: Tulane Studies Geology and Paleontology, v. 7, no. 1, p. 1-40, illus., 1969.

Seven named species of the arcacean pelecypod genus *Anadara* are here recognized as referable to the subgenus *Caloosarca* Olsson, 1961; these have a combined stratigraphic range of upper Miocene-Holocene and a geographic range along the Atlantic and Gulf coasts from North Carolina to southern Brazil. *A. (C.) notabilis* lives in relatively shallow waters; of the other six species, known only as fossils, five are apparently confined to peninsular Florida. A probable eighth species is represented by three specimens from the Miocene of Lee County, Fla. Revised diagnoses of genus

and subgenus are given. Type species of the subgenus is *A.* (*C.*) *rustica*, lower Pliocene, South Carolina. Two new species, *notoflorida* and *hoerleae*, are described from the upper Miocene Pinecrest Formation of southern Florida.—VMJ

03523 **Voldet, Pia.** Dosage direct et sans séparation du magnésium dans divers types de roches, par spectrophotométrie d'absorption atomique: Soc. Physique et Histoire Nat. Geneve Compte Rendu, new ser., v. 3, no. 3 (Archives Sci., v. 21, supp., 1968), p. 93-101, illus., tables, 1969.

A method for direct determination, without separation, of magnesium in various types of standard rocks by atomic absorption spectrophometry is described. Addition of increasing quantities of magnesium oxide permitted determination of the content of MgO from 1-50 percent on rock samples 3-40 g/ml. The contents found in the standards correspond to those obtained by other methods of analysis, maximum error being 0.15 percent.—ESL

03334 **vonHake, Carl.** Recent earthquakes of note: Earthquake Notes, v. 40, no. 1, p. 23-24, 1969.

The strong earthquake of November 9, 1968, centered in southern Illinois, was felt over 23 states. The epicentral area is known as a zone of frequent minor earthquakes and a few large ones; most famous are the three of 1811-1812, centered near New Madrid, Mo. On February 28, 1969, a large earthquake shook an area in Portugal, Spain, and Morocco; the magnitude is estimated at 7.8-8.0, comparable to one on May 16, 1968, centered off the east coast of Honshu, Japan. One of the greatest seismic events in history took place in 1755, with the epicenter about 60 to 100 miles west of Lisbon, about the same as the one in 1969.—ESL

03540 **Voskuil, Walter H.** A geography of minerals: Dubuque, Iowa, Wm. C. Brown Co. Publishers (Brown Foundations of Geography Ser.), 117 p., illus., tables, 1969.

A mineral geography survey portrays only known deposits, and among these, only such as are of distinct economic significance; it can be only tentative and cannot include an exhaustive catalog of all reported deposits. An introductory chapter examines economic valuation of a mineral deposit, and ore reserves in relation to modern ocean transportation and changing technology. Other chapter headings are: iron ores, iron-making fuels and alloys, solid fuels, petroleum and natural gas, nonferrous metals, plant foods, building materials, gold, silver, and platinum, and nuclear fuels. Brief mineral notes, a bibliography, and an index complete the volume.—MCM

Vvedenskaya, A. V. *See* Balakina, L. M. 03083

03184 **Waag, Charles Joseph.** Structural geology of the Mt. Bigelow-Bear Wallow-Mt. Lemmon area, Santa Catalina Mountains, Arizona [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3795B-3796B, 1969.

02964 **Wagner, Frances J. E.** Faunal study, Hudson Bay and Tyrrell Sea, *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 7-48, illus., tables, 1969.

Published records of fossil and living species of Hudson and James Bays, and their fore-runner, the Tyrrell Sea, date back to 1862. Two hundred and sixty-three species have been recorded—26 only as fossils, and 120 only in recent deposits. Species collected from Hudson Bay in 1965 showed distributional variation to be related primarily to bottom sediment texture and dissolved oxygen content of water, with depth apparently of secondary importance. Bottom temperature, salinity, and hydrogen-ion concentration were relatively uniform at depths sampled (35-286 m) and were not significant with regard to distribution of species. Faunal changes shown by fossil assemblages from Tyrrell Sea suggest water temperatures were probably not dissimilar to those of Hudson Bay, but waters were probably less saline than at present. Radiocarbon dates on marine shells indicate Tyrrell Sea may have reached its maximum extent between 5,000 and 6,000 B.C.—*from* Author's abstract

03654 **Wahlstrom, Ernest E.; Nichols, T. C., Jr.** The morphology and chronology of a landslide near Dillon Dam, Dillon, Colorado: Eng. Geology—Internat. Jour., v. 3, no. 2, p. 149-174, illus., tables, 1969.

Detailed laboratory and field analyses of the mineralogy, chemistry and physical properties of landslide materials and bedrock source provide an understanding of important factors contributing to the origin and reactivation of a landslide in overburden resting on the Morrison Formation. The landslide material is dominantly an aggregate of angular fragments of quartzite and sandstone from the Dakota Formation in a matrix of fine-grained to colloidal clay derived from the upper, noncalcareous part of the Morrison Formation. During construction of Dillion Dam, excavation at the the toe of a relatively stable old landslide caused renewed movement that threatened engulfment of the intake structure at the portal of the diversion tunnel for the reservoir. Remedial measures included further excavation of the landslide and construction of a gravel-fill coffer-dam at its toe.—*from* Author's summary

Waldrop, Henry A. *See* Fraser, George D. 03391

03546 **Walker, George W.; King, Philip B.** Geologic map of Oregon: U.S. Geol. Survey Misc. Geol. Inv. Map I-595, scale 1:2,000,000, 1969.

03570 **Wallace, Robert E.** Geologic factors in earthquake damage, *in* CENTO conference on earthquake hazard minimization, Ankara, 1968: Ankara, Turkey, U.S. Econ. Coordinator CENTO Affairs, p. 123-133, illus., 1969.

Four types of geologic factors should be considered in earthquake damage: (1) failure of unstable ground under earthquake excitation, (2) faulting, (3) tectonic warping, and (4) influence of ground on shaking. These geologic factors cannot yet be controlled by engineering techniques. Regions characterized by these conditions must either be avoided or used in special low-hazard ways.—KAF

02960 **Walmsley, V. G.; Boucot, A. J.; Harper, C. W.** Silurian and Lower Devonian salopinid brachiopods: Jour. Paleontology, v. 43, no. 2, p. 492-516, illus., table, 1969.

The schizophoriid enteletacean brachiopod genus *Salopina* includes, in addition to the type species *S. lunata*, *Dalmanella submedia*, *D. conservatrix*, *D. missendenensis*, *D. crassiformis*, *Orthis tubulata*, and four new species, *S. robitaillensis*, *S. hitchcocki*, *S. hazardensis*, and *S. shelvensis*. The genus is known from rocks of Silurian (late Llandoverian) to Devonian (Eifelian) age in Belgium, Britain, Gotland, Podolia, New Brunswick, Nova Scotia, Quebec, Yukon, Kentucky, Maine, Massachusetts, Nevada, Pennsylvania, and Bolivia. *Salopina* and two other genera are removed from the Schizophoriinae and assigned to Draboviinae, here emended; phylogenetic relationships are suggested for genera of these subfamilies, and for subfamilies of the Dalmanellidae, Schizophoriidae, and Enteletidae.—*from* Authors' abstract

03431 **Wanek, Alexander A.; Callahan, James E.** Geology of proposed powersites at Deer Lake and Kasnyku Lake, Baranof Island, southeastern Alaska: U.S. Geol. Survey Bull. 1211-C, p. C1-C25, illus., table, geol. maps, 1969.

This report is based on reconnaissance geologic investigations of proposed powersites at Deer Lake and Kasnyku Lake on the east side of Baranof Island. Rugged terrain makes direct access impossible. The sites were examined to furnish geologic information for use in evaluating some of the waterpower resources of southeastern Alaska. Many of the linear features of Baranof Island are believed to be along prominent joint systems. No evidence of faulting was found at the powersites. Waterpower development of Deer Lake would best be accomplished by the construction of a dam to raise the lake level and by drawdown below normal lake level. If Kasnyku Lake is not suitable for a damsite because of its depth, and permeability of talus, the possibility of regulating the storage capacity of the lake by drawdown should be considered.—JNR

Wang, Frank F. H. *See* McKelvey, V. E. 03513

Waugh, T. C. *See* Angino, E. E. 03320

Waugh, Truman C. *See* Tien, Pei-Lin. 03531

03013 **Weber, J. R.; Goodacre, A. K.** An analysis of the crust-mantle boundary in Hudson Bay from gravity and seismic observations [abs.], *in* Earth science symposium on Hudson Bay, Ottawa, 1968: Canada Geol. Survey Paper 68-53, p. 270-271, 1969.

03163 **Weidner, Jerry Raymond.** Phase equilibria in a portion of the system Fe-C-O from 250 to 10,000 bars and 400°C to 1200°C and its petrologic significance [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 10, p. 3708B-3709B, 1969.

West, T. S. *See* Kirkbright, G. F. 03512

03643 **West Texas Geological Society.** Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, 134 p., illus., 1969.

This is a supplement to the original volume published in 1966 (West Texas Geol. Soc. Pub. 66-52); these two volumes augment the 1957 volume published by the Texas Univ. Bur. Econ. Geology, "Occurrence of oil and gas in west Texas," in a continuing effort to document the occurrence of hydrocarbon production in the area. It is planned to publish additional volumes periodically. A paper by J. S. Martin and summaries of the individual fields are cited separately.—MCM

03018 **Westermann, Dale Thomas.** The effect of selected potassium salts on the availability of soil manganese [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 3994B, 1969.

03101 **Wheeler, J. A.** Frederick H. Bockelman, Jr. (1923-1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 7, p. 1522, portrait, 1969.

White, Richard A. *See* Leestma, Roger A. 03364

03412 **White, William B.** Conceptual models for carbonate aquifers: Ground Water, v. 7, no. 3, p. 15-21, illus., 1969.

Carbonate aquifers have been subdivided into three major types with a number of subtypes. The classification of a particular aquifer into one of these types can be made on the basis of easily observed hydrogeological conditions. Each type has associated with it a particular flow pattern and a characteristic pattern for the fragments of cave that are left behind as the water table is lowered. The usual controls of structure, lithology, and position of base level are shown to act mainly to perturb the gross pattern and to determine some of the detailed morphology of the resulting drainage network.—Author's conclusions

02978 **Whitehead, Neil E.; Brooks, Robert R.** A comparative evaluation of scintillometric, geochemical, and biogeochemical methods of prospecting for uranium: Econ. Geology, v. 64, no. 1, p. 50-55, illus., tables, 1969.

The following ground-prospecting techniques were tested in a uraniferous area of New Zealand (Buller Gorge area) as follow-ups for airborne scintillometer surveys: gamma scintillometry, gamma spectrometry, and the measurement of alpha and beta activities and uranium content (fluorometric) of plants and soils. Statistical analysis of the data and review of other evidence from the area lead to the conclusions that fluorometric analysis of plants and soils provides the most reliable guides to uranium.—WSW

03114 **Whittington, H. B.; Richards, R. B.** Development of *Glossograptus* and *Skiagraptus*, Ordovician graptoloids from Newfoundland: Jour. Paleontology, v. 43, no. 3, p. 800-817, illus., 1969.

Graptolites were obtained by dissolving limestone boulders from the Cow Head Group (western Newfoundland) in dilute hydrochloric acid. The limestone boulders are correlated with the upper middle Table Head Formation and late Whiterock

Stage (upper Middle Ordovician) on the basis of trilobite faunas. Developmental stages of *Glossograptus holmi*, the most abundant species, and *Skiagraptus* sp., a rare form, are described and illustrated. An incomplete specimen of an early stage *Paraglossograptus*, is illustrated.—JWH

Wideman, C. J. *See* Romig, P. R. 03597

Wilkins, R. W. T. *See* Vedder, Willem. 03458

03619 **Williams, J. R. S. E. Good (Fusselman),** *in* Oil and gas fields in West Texas—Symposium, V. 2: West Texas Geol. Soc. Pub. 69-57, p. 61-64, illus., 1969.

03601 **Williams, James H.** Can ground-water pollution be avoided?: Ground Water, v. 7, no. 2, p. 21-33, illus., 1969.

Pollution of ground water to the point of crisis in Missouri can be eliminated by an awareness of geology, by planning, by adequate funding, and by authority to follow planning. Ground-water pollution hazards are widespread in southern Missouri where permeable soils and cavernous bedrock exist. Pollution in northern Missouri is more localized. All of the pollution in Missouri that we have attributed to geologic features could have been avoided if the polluters—municipal and private—had obtained adequate geologic information, used common sense, and supported waste-disposal plans with adequate financing.—Author's abstract

03574 **Wilson, James Lee.** Microfacies and sedimentary structures in "deeper water" lime mudstones, *in* Depositional environments in carbonate rocks—A symposium: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 14, p. 4-19, illus., 1969.

Limestones deposited in downslope or in basinal positions possess several distinctive criteria based on microfacies, bedding, and fauna. The microfacies include: (1) homogeneous lime mudstone, (2) millimeter laminated lime mudstone, and (3) common micropelletoid lime grainstone (calcisiltite). Field observations show that this kind of limestone commonly forms an apron down very gentle slopes from typical carbonate shelves. Basins in which this type deposition occurs may be 300 to 2,000 feet deep. Examples of "deeper water" but nonturbidite limestones are discussed from basins and geosynclinal troughs in the late Paleozoic of the western United States, the Cretaceous and Jurassic of Mexico, the Middle East, and Europe.—*from* Author's abstract

03044 **Wiltse, Milton Adair, Jr.** An electron microprobe investigation of a natural sulfide assemblage occurring at Balmat, New York [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 11, p. 4233B, 1969.

Withers, T. H. *See* Newman, William A. 03491

03636 **Withington, Charles F.; Sable, Edward G.** Geologic map of the Rock Haven quadrangle, Kentucky-Indiana, and part of the Laconia quadrangle, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-780, scale 1:24,000, section, text, 1969.

A limited development of industrial minerals and organic fuels has been undertaken in the map-area, nearly one-quarter of which is occupied by Fort Knox Military Reservation and Otter Creek Park. Two gas fields which produced from a few wells for local heating have been converted into storage reservoirs for gas produced elsewhere. A few oil wells of minor importance have been reported; any major discovery would probably be from rocks below the New Albany Shale. Shaly limestone has been quarried for cement; other rocks would be suitable for limestone aggregate. Some red clay soil has been used for brick, sand and gravel have been excavated from a terrace deposit, and gypsum has been found in small amounts. —MCM

03537 **Wolman, Abel.** Water, health and society (selected papers edited by Gilbert F. White): Bloomington, Ind., and London, Indiana Univ. Press, 400 p., illus., tables, 1969.

This collection of writings of Abel Wolman has been reprinted from various sources published between 1918 and 1966. The topics covered include water quality and treatment, search for standards, water planning and policy, comprehensive planning for human environment, and role of the engineer. A bibliography of 184 items is included.—MCM

03135 **Wood, Albert E.** Rodents and lagomorphs from the "*Chadronia* Pocket," early Oligocene of Nebraska: Am. Mus. Novitates, no. 2366, 18 p., illus., tables, 1969.

Early Oligocene rodents and lagomorphs have been collected from the *Chadronia* Pocket north of Crawford, Nebr. The most important aspect of the collection is its striking contrast with the previous picture of early Oligocene rodents, based largely on collections from Pipestone Springs, the Horsetail Creek beds, northeastern Colorado; material from McCarty's Mountain, Mont.; and that from the Yoder Formation of Wyoming. This raises a question as to correlation of these early Oligocene localities. Several possible explanations of observed data are discussed. There must have been an ecological difference, and there may have been a faunal barrier, between northwestern Nebraska and central Montana in the early Oligocene. The rodents of the *Chadronia* Pocket suggest a very short time interval before middle Oligocene.—KAF

03637 **Wood, Gordon H., Jr.; Arndt, Harold H.** Geologic map of the Shenandoah quadrangle, Schuylkill County, Pennsylvania: U.S. Geol. Survey Geol. Quad. Map GQ-781, scale 1:24,000, sections, 1969.

03281 **Woodburne, Michael O.** Systematics, biogeography, and evolution of *Cynorca* and *Dyseohyus* (Tayassuidae): Am. Mus. Nat. History Bull., v. 141, art. 2, p. 271-356, illus., tables, 1969.

The genus *Cynorca* Cope, 1867, is a small Miocene peccary which stands at the base of the second evolutionary radiation of the Tayassuidae. *C. proterva* Cope (1867), the genotypic species is known from deposits of probably early late Miocene in Maryland, South Carolina, Texas, and Nebraska. *C. proterva* probably arose from a local, coastal population of *C. sociale* sometime in early or middle Miocene. *Dyseohyus* Stock, 1937, is a larger and more advanced derivative of *Cynorca*. The more primitive of the two *Dyseohyus* species, *D. fricki*, is restricted to the late Miocene of California. The more advanced species, *D. stirtoni*, is found in late Miocene deposits in Colorado, Nebraska, and Texas. Systematics of *Cynorca* and *Dyseohyus* are given.—KAF

03358 **Woodford, A. O.** Serial literature used by American geologists, 1967: Jour. Geol. Education, v. 17, no. 3, p. 87-90, tables, 1969.

A statistical analysis is made of 16,441 references listed at ends of articles in seven widely read American geological journals for the year 1967, three of them general and four specialized. Summarized for total number of pages and number of references by different types, 13,576 refer to serial articles, 28.2 percent in serials published outside of the United States and Canada, and 9 percent in foreign languages. Similar study was made by H. C. Cramer, of 6,919 references in four journals for the year 1960; and by Gross and Woodford (1931) for the year 1929, totalling 4,184 in six of the journals used in the present inquiry, omitting the Journal of Paleontology. Also tabulated are numbers of citations by decades since pre-1908 of the 29 serials most frequently cited, and references to 86 serials cited 16 to 53 times; seven of the 29 serials, and 27 of the 86 did not exist in 1929.—GDC

Worzel, J. L. *See* Burk, C. A. 03107

Wright, Gary A. *See* Griffin, James B. 03310

03556 **Wright, Gary A.; Griffin, James B.; Gordus, Adon A.** Preliminary report on obsidian samples from Veratic Rockshelter, Idaho: Tebiwa, v. 12, no. 1, p. 27-30, illus., tables, 1969.

Twenty obsidian samples from this site were analyzed by neutron activation for their sodium and manganese content, and were determined to be from the Yellowstone Park area with one exception; the exception was possibly from Oregon.—HRC

Zeiss, Harvey S. *See* Newman, Walter S. 03582

Zemann, Josef. *See* Correns, Carl W. 03303

03111 **Ziegler, Alan C.** A theoretical determination of tooth succession in the therapsid *Diademodon*: Jour. Paleontology, v. 43, no. 3, p. 771-778, illus., 1969.

Possible dental replacement patterns of the early Triassic gomphodont cynodont *Diademodon* are investigated by theoretical tooth succession models from the literature. The most probable pattern involves only two Zahnreihen (sets). The primary set consists of three or four incisors, one canine, and up to sixteen postcanines. The secondary set is shorter, consisting of single replacements of the incisors, the canine, and the anterior four to six postcanines. The remaining postcanines of the primary set remain functional for life. All replacement teeth have appeared before the twelfth postcanine and posterior primary teeth have erupted. This replacement pattern is essentially like that of mammals, although *Diademodon* cannot be considered an immediate mammalian ancestor.—*from* Author's abstract

03483 **Zietz, Isidore; Bateman, Paul C.; Case, James E.; Crittenden, M. D., Jr.; Griscom, Andrew; King, Elizabeth R.; Roberts, R. J.; Lorentzen, George R.** Aeromagnetic investigation of crustal structure for a strip across the western United States: Geol. Soc. America Bull., v. 80, no. 9, p. 1703-1714, illus., 1969.

The aeromagnetic map strip is 100 miles wide, extending from Denver, Colo., to the Pacific Ocean west of San Francisco. Flight tracks are five miles apart. Tectonic units or features on the map include the Front Range, North Park, Uinta Uplift and Basin, Wasatch Mountains, Basin and Range Province, Sierra Nevada, Great Valley, Coast Ranges, San Andreas fault, and Continental Shelf and Slope. Each unit tends to have a characteristic magnetic pattern. East-west magnetic lineaments, some as long as 400 miles, may represent fracture zones which in turn may be related to the east-west fracture zones beneath the oceans.—AG

03438 **Zimmerman, J. B.; Thomas, Eugene.** Sulfur in West Texas—Its geology and economics: Texas Univ. Bur. Econ. Geology Geol. Circ. 69-2, 35 p., illus., 1969.

Sulfur production, demand, and economics are reviewed, including that for Frasch sulfur. The stratigraphy of the deposits in western Texas, and origin of the native sulfur, comprise the second section. The following pages review land and leasing; exploration methods; reserve calculations, and costs; and water supply. Five Frasch mining operations are described. Ample reserves of sulfur are present throughout the Free World to meet any anticipated demands, but Frasch reserves are limited and should be handled with restraint.—ESL

02976 **Zoltai, S. C.** Sampling fossil mollusks from glacial Lake Agassiz sediments: Jour. Paleontology, v. 43, no. 2, p. 534-537, illus., tables, 1969.

Pleistocene mollusks were collected from Lake Agassiz sediments at 10 localities in the Rainy River area, Ontario, near the Manitoba and Minnesota boundaries. The mollusks were found in offshore and foreshore lacustrine sediments, beaches, and a deltaic deposit, all related to the Campbell phase, about 9,500 years B.P. The mollusks were most abundant in shallow water near the beaches and in offshore shoals. No relict species were found; sphaeriid clams were most abundant in species and individuals, followed by branchiate and pulmonate snails. The combination of surface sampling and bulk sampling methods, used wherever possible, was found to give a better approximation of the quality of the fauna, where only one fossiliferous stratum is present, than either method separately.—VMJ

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